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VOLUME XX FEBRUARY 2, 1931 NUMBER

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Color Reactions as a Means of Identifying Vat Colors on Cotton

By ANTHRAGOID

IN VIEW of the ever-increasing demand for faster colors, both in plain dyeing and printing, the range of vat colors is constantly being augmented and improved.

As might be expected from a class of colors comparatively recently developed and compended, there are wide differences of fastness (of washing in particular), and price or rather money value between the individual members of the class. This is true also for vat colors of the same or practically the same shade. Unfortunately or otherwise, depending on the point of view, the more fugitive vat colors are more easily applied to cotton piece goods, particularly in plain dyeing.

When it is considered that these colors are also appreciably lower in price (for the same depth of shade), than the faster variety, it is not to be wondered at that the more fugitive type of vat color still wages a stern though losing battle.

GREEN

Colour Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
	Indanthrene Green G	Navy Blue	Blue	Yellow	Olive	Yellow	Insoluble	Insoluble	Insoluble
1116	Indanthrene Green BB	Green Blue	Grey Blue	Green to Blue	Green	Unaltered	Insoluble	Insoluble	Insoluble
	Indanthrene Brilliant Green B	Bordeaux	Blue	Blue Green	Violet	Duller	Insoluble	Insoluble	Blue Green
	Indanthrene Brilliant Green GG	Bordeaux	Blue	Blue Green	Violet	Olive	Insoluble	Olive	Olive
1198	Ciba Green G	Yellow	Orange	Tan	Violet	Grey	Insoluble	Insoluble	Insoluble
1174	Cibanone Green G	Bordeaux	Green Blue	Blue Green	Brown	Unaltered	Insoluble	Insoluble	Insoluble
	Indanthrene Green GG	Dark Green	Violet	Unaltered	Unaltered	Yellow Green	Insoluble	Yellow Green	Yellow
	Hydron Green B	Blue Green	Blue	Blue Green	Unaltered	Reddish-Brown	Insoluble	Yellow Green	Yellow
	Hydron Green G	Blue Green	Violet	Blue Green	Unaltered	Brown	Insoluble	Yellow Green	Yellow
1199	Helindone Green G	Yellow Green	Orange	Olive Green	Blue	Brown	Insoluble	Green	Yellow
	Helindone Brilliant Green D5G	Brown	Blue	Blue Green	Olive	Duller	Insoluble	Yellow Green	Yellow Green
1173	Indanthrene Blue Green B	Violet	Blue	Blue	Dull Tan	Grey Green	Insoluble	Olive	Olive
	Alizarine Indigo Green G	Green Yellow	Orange	Light Olive	Violet	Grey Olive	S. Green	S. Green	Yellow
	Alizarine Indigo Green B	Tan	Reddish-Brown	Brown	Olive Green	Unaltered	Insoluble	Green	Insoluble

In consequence it becomes imperative, on account of the competitive conditions in which we now exist, that a sample be matched with identical and not merely similar colors.

It is no longer economically practicable simply to match a vat color with another of the approximate shade.

A series of color reactions have been evolved enabling vat dyestuffs of a similar or equal shade to be differentiated.

In addition it gives each individual vat color a series of more or less radical color changes, one or more of which will distinguish it from all other vat dyestuffs.

Existing methods of identifying vat colors are confined to the following:

I. Boiling the sample with a dilute solution of sodium hydrosulphite.

II. Vatting the sample with a solution of sodium hydrosulphite and caustic soda.

III. Boiling with a solution of caustic soda.

YELLOW and ORANGE

Colour Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
	Indanthrene Golden Yellow GK	Unchanged	Red	Violet	Violet	Unaltered	Yellow	Yellow	Yellow
	Indanthrene Yellow GF	Orange	Grey Brown	Brown	Yellow	Unaltered	Insoluble	S. Yellow	Yellow
	Indanthrene Yellow 3 GF	Tan	Green	Olive	Yellow	Unaltered	Insoluble	S. Yellow	Yellow
	Indanthrene Yellow RK	Olive	Reddish Brown	Brown	Tan	Unaltered	Insoluble	S. Yellow	Yellow
	Indanthrene Yellow GGK	Yellow	Bordeaux	Violet	Yellow	Unaltered	Insoluble	Yellow	Yellow
	Indanthrene Yellow FFRK	Olive	Orange	Brown	Red	Unaltered	Insoluble	Yellow	Yellow
1132	Indanthrene Yellow GK	Yellow	Brown	Brown	Yellow	Unaltered	Insoluble	Yellow	Yellow
1118	Indanthrene Yellow R & G	Dull Blue	Blue	Blue	Yellow	Unaltered	Insoluble	S. Yellow	Olive
	Indanthrene Yellow NG	Blue Green	Blue	Violet	Yellow	Unaltered	Insoluble	S. Yellow	Olive
	Cibanone Yellow 3G	Olive	Dull Orange	Brown	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
1170	Cibanone Yellow R	Slightly Redder	Brown	Brown	Reddish Brown	Unaltered	Insoluble	Insoluble	Insoluble
1196	Ciba Yellow G	Olive	Bordeaux	Olive	Orange	Unaltered	Yellow	Yellow	Yellow
	Algol Yellow GC	Orange	Violet	Bordeaux to Violet	Yellow	Unaltered	Insoluble	Yellow	Yellow
	Algol Yellow WF	Yellow	Olive	Olive	Yellow	Unaltered	Insoluble	Yellow	Yellow
	Vat Yellow R	Orange	Brown Black	Olive	Yellow	Unaltered	Insoluble	Insoluble	Insoluble
1159	Hydron Yellow GG	Brown Orange	Black Violet	Black Brown	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
1176	Thioindigo Yellow GW	Pale Yellow	Pale Yellow	Yellow	Bordeaux	Unaltered	Insoluble	S. Yellow	S. Yellow
1139	Algol Yellow 3 G	Yellow	Scarlet	Yellow Brown	Yellow	Unaltered	Insoluble	S. Yellow	Yellow
1138	Helindone Yellow 3 GN	Yellow Green	Reddish Brown	Brown	Scarlet	Unaltered	Insoluble	Yellow	Red
1159	Hydron Yellow NF	Orange	Brown	Brown	Unaltered	Slightly Green	S. Yellow	Yellow	Yellow
1136	Indanthrene Orange RRK	Yellow	Reddish Brown	Reddish Brown	Yellow	Yellow	S. Orange	Yellow	Dull Pink
	Indanthrene Orange RRT	Brown	Violet	Violet	Violet	Unaltered	Insoluble	Yellow	Yellow Green
	Indanthrene Orange 4 R	Reddish Brown	Violet	Violet	Violet	Unaltered	Insoluble	Yellow	Yellow
	Indanthrene Orange 3 R	Reddish Brown	Blue	Dull Bordeaux	Yellow	Unaltered	Insoluble	Yellow	Dull Violet
1137	Indanthrene Orange 6 RTK	Brown	Reddish Brown	Brown	Brown	Unaltered	Insoluble	Orange	Orange
1096	Indanthrene Golden Orange G	Unchanged	Violet	Violet	Blue	Unaltered	Insoluble	Yellow	Yellow
	Indanthrene Golden Orange 3G	Yellow Brown	Reddish Brown	Brown	Tan	Unaltered	Insoluble	S. Yellow	S. Yellow
	Cibanone Orange 3 R	Yellow	Orange	Brown	Orange	Yellow	Insoluble	S. Yellow	S. Orange
	Cibanone Orange 6 R	Yellow	Orange	Brown	Red	Unaltered	S. Yellow	Orange	Orange
1217	Helindone Orange R	Brown	Yellow	Brown	Violet	Unaltered	Insoluble	Orange	Orange
1215	Helindone Orange D	Orange	Yellow	Brown	Blue	Unaltered	Insoluble	S. Yellow	S. Yellow

IV. Spotting the sample with concentrated sulphuric acid.

With a complete range of vat colors such as exemplified in the following tables, these four reactions are not sufficient to distinguish between the many dyestuffs of the same general color.

The additional reactions are found to supply a simple remedy for the above. Actually, with practice, it is possible to determine the identity of shading colors, providing one only has been used for the purpose; this can only be accomplished by a careful study of the solubility reactions in benzol, pyridine and pyridine and caustic respectively.

The sample to be identified is divided into the requisite number of portions and the following tests made:

(a) A portion is boiled with sodium hydrosulphite (hydro), and the change of color noted.
(b) A few drops of 72°Tw. Caustic Soda are added to the above, at the boil, and the color change again remarked.
(c) A second portion is boiled with 72°Tw. Caustic Soda.
(d) A third portion is spotted with concentrated sulphuric acid.
(e) Another is spotted with concentrated nitric acid.
(f) A fifth portion is boiled with benzol and the color of the solution noted.

GREY and BLACK

Colour Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
1145	Indanthrene Grey K	Unchanged	Brown	Green	Olive	Dull Bordeaux	Insoluble	Pink	Dull Bordeaux
1145	Indanthrene Grey GK	Olive Brown	Dark Brown	Olive Green	Olive to Brown	Unaltered	S. Violet	Insoluble	Insoluble
	Indanthrene Grey BTR	Black	Dark Blue	Dark Blue	Olive Brown	Olive Brown	Insoluble	Insoluble	Insoluble
	Indanthrene Grey RRH	Black Brown	Dark Blue	Dark Blue	Brown	Brown	Insoluble	Insoluble	Insoluble
	Indanthrene Grey 3 B	Dull Bordeaux	Blue	Blue	Reddish	Unaltered	Insoluble	Insoluble	Insoluble
1213	Indanthrene Grey 6 B	Green Yellow	Yellow	Green Yellow	Violet	Violet	Insoluble	Green Blue	Green Blue
1220	Ciba Grey B & G	Pale Yellow	Yellow	Yellow	Dull Violet	Unaltered	S. Violet	Insoluble	Insoluble
	Alizarine Indigo Grey B	Green Yellow	Yellow	Olive	Dull Blue	Unaltered	Insoluble	Green	Yellow
1123	Anthra Grey B	Olive Green	Dark Brown	Dark Olive Green	Olive	Olive Brown	Insoluble	S. Yellow	Yellow
	Indanthrene Printing Black B	Green Yellow	Yellow	Green	Blue	Brown	S. Blue	Blue	Green Yellow
1102	Indanthrene Black BB	Black Brown	Dark Blue	Dull Blue	Violet	Unaltered	S. Pink	Dull Green	Olive Green
	Indanthrene Printing Black BR	Dark Bordeaux	Violet	Dull Blue	Violet	Unaltered	Violet	Violet	Blue
	Helindone Printing Black 2 BD	Olive Brown	Yellow	Dark Brown	Dark Blue	Brown	S. Blue	Green	Yellow Green
	Helindone Printing Black RD	Olive	Brown Yellow	Dark Green	Dark Blue	Black Brown	Blue	Blue Black	Olive
	Helindone Printing Black BG	Reddish-Brown	Bordeaux	Black	Unaltered	Black Brown	Violet	Blue Green	Blue Green
	Helindone Printing Black G	Grey Brown	Reddish-Brown	Greener	Unaltered	Tan	S. Violet	Blue Green	Brown
1172	Cibanone Black 2 G	Dull Bordeaux	Bordeaux	Black	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
	Vat Printing Black G	Green Black	Green Black	Green Blue	Unaltered	Brown	S. Violet	Dull Blue Green	Olive Brown
	Hydron Black B	Yellow Brown	Olive	Blue Green	Unaltered	Unaltered	Blue	Blue	Yellow Green
	Hydron Black BN	Olive Brown	Olive	Blue Green	Unaltered	Unaltered	Insoluble	Violet	Green
	Alizarine Indigo Black B	Olive	Yellow	Brown	Unaltered	Unaltered	Blue	Blue	Yellow Green

(g) A sixth is boiled with pyridine and the color of the solution noted.

(h) A few drops of 72°Tw. Caustic Soda are added to (g), at the boil, and the color change again noted.

The following forms of the various reagents have been used for the several reactions enumerated above.

Sodium hydrosulphite .....concentrated powder.
Caustic Soda.....72°Tw.
Sulphuric Acid .....96 per cent or 168°Tw.
Nitric Acid .....65 per cent or 80°Tw.
Benzol.....chemically pure.
Pyridine.....technical.

It is essential to conduct these reactions with standard amounts of the above reagents.

The abbreviation "s" in the various columns denotes "slightly soluble."

BROWN

Colour Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
1151	Indanthrene Brown R	Unchanged	Redder	Darker	Pink	Redder	Insoluble	Brown	Dull Yellow
1152	Indanthrene Brown G	Unchanged	Unchanged	Darker	Pink	Unaltered	Insoluble	Brown	Olive
	Indanthrene Brown FER	Tan	Unchanged	Darker	Red	Unaltered	Insoluble	Yellow	Yellow
	Indanthrene Brown RT	Unchanged	Darker	Darker	Pink	Redder	Insoluble	Tan	Dull Yellow
1149	Indanthrene Brown GR	Black Brown	Darker	Darker	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
	Indanthrene Red Brown R	Unchanged	Dull Bordeaux	Darker	Unaltered	Unaltered	S. Brown	Tan	Yellow
	Indanthrene Brown 3 R	Redder	Violet	Violet	Yellower	Unaltered	Insoluble	S. Orange	Tan
	Indanthrene Brown GG	Unchanged	Unchanged	Darker	Pink	Redder	Insoluble	Tan	Yellow
	Indanthrene Printing Brown 3 R	Unchanged	Yellow	Unchanged	Red	Unaltered	S. Pink	Orange	Dull Orange
	Indanthrene Printing Brown R	Tan to Yellow	Yellow	Tan to Yellow	Unaltered	Unaltered	S. Pink	Orange	Yellow
	Indanthrene Brown NR	Yellower	Yellower	Darker	Yellower	Yellower	Insoluble	S. Tan	Orange
1187	Ciba Brown R	Yellower	Yellow	Green	Violet	Unaltered	Pink	Red	Olive
	Hydron Brown G	Unchanged	Darker and Redder	Black Brown	Unaltered	Unaltered	Insoluble	Yellow Brown	Yellow
	Hydron Brown R	Unchanged	Darker and Redder	Black Brown	Unaltered	Unaltered	Insoluble	Brown	Yellow Brown
1171	Cibanone Brown B & V	Unchanged	Darker	Bordeaux	Unaltered	Unaltered	Insoluble	S. Brown	Brown
	Hydron Yellow Brown G	Yellow	Darker	Redder	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
1227	Helindone Brown G	Yellower	Yellow	Yellower	Bordeaux	Unaltered	Insoluble	Yellow	Yellow
1223	Helindone Brown 2 R	Yellower	Yellow	Yellower	Violet	Unaltered	Insoluble	Yellow	Yellow
1224	Helindone Brown 5 R	Unchanged	Orange	Unaltered	Blue	Unaltered	S. Pink	Orange	Yellow
1148	Helindone Brown 3 G N	Unchanged	Redder	Darker	Redder	Yellower	Insoluble	Brown	Red
	Thioindone Brown GT	Yellower	Yellow	Yellowish	Unaltered	Unaltered	Orange	Brownish-Orange	Brown
	Helindone Brown GGR	Yellower	Yellow	Yellowish	Unaltered	Unaltered	Insoluble	Orange	Yellow
1150	Indanthrene Olive R	Brown	Reddish-Brown	Dull Bordeaux	Violet	Unaltered	Insoluble	Insoluble	Insoluble
	Indanthrene Khaki GG	Green	Bordeaux	Violet	Olive Brown	Unaltered	Insoluble	Insoluble	Insoluble
	Hydron Olive GN	Yellow Brown	Brown	Bordeaux	Brown	Unaltered	Insoluble	Insoluble	Insoluble
	Hydron Yellow Olive GG	Browner	Dark Brown	Dull Bordeaux	Yellower	Unaltered	Insoluble	Insoluble	Insoluble
1167	Anthra Olive G	Unchanged	Blue Green	Green	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble

BLUE

Colour Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
969	Hydron Blue R	Yellow	Yellow	Olive	Blue	Unaltered	Insoluble	Insoluble	Insoluble
971	Hydron Blue G	Yellow	Yellow	Olive	Blue	Unaltered	Insoluble	Insoluble	Insoluble
972	Hydron Black Blue G	Olive	Green	Green	Unaltered	Unaltered	Insoluble	S. Pink	Olive
	Hydron Navy Blue C	Olive	Green	Violet	Unaltered	Unaltered	Insoluble	S. Pink	Brown
	Hydron Black Blue G G	Olive	Green	Olive	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
971	Hydron Blue B	Olive	Yellow	Yellow	Unaltered	Slightly Greener	Insoluble	Insoluble	Insoluble
	Hydron Sky Blue F K	Light Yellow	Light Orange	Yellow	Bordeaux	Unaltered	S. Blue	Green Blue	Green
1115	Indanthrene Blue G C & G C N	Blue	Dull Blue	Green Blue	Olive Green	Light Olive	Insoluble	Insoluble	Insoluble
1114	Indanthrene Blue B C S	Green Blue	Blue	Green Blue	Blue	Yellowish-Green	Insoluble	S. Green	Yellow
1113	Indanthrene Blue G C D N	Coon Blue	Blue	Green Blue	Greyish-Green	Yellow	Insoluble	S. Green	Greenish-Yellow
1106	Indanthrene Blue R S	Violet	Reddish-Blue	Blue	Olive Brown	Yellow	Insoluble	S. Olive	Greenish-Yellow
1108	Indanthrene Blue R K	Navy Blue	Brown	Blue	Olive	Yellow	S. Blue	Green	Green
	Indanthrene Blue 3 G T	Unchanged	Slightly Greyer	Green Blue	Olive	Light Blue	Insoluble	S. Green	Yellow
1109	Indanthrene Blue 3 G	Navy Blue	Grey Blue	Olive	Dull Yellow	Yellow	Insoluble	Green	Greenish-Yellow
1111	Indanthrene Blue 5 G	Dark Blue	Black Blue	Blue Green	Green	Green	Insoluble	Insoluble	Insoluble
	Indanthrene Blue 8 G K	Orange	Violet	Violet	Brown	Brown	Insoluble	S. Green	Yellow
1099	Indanthrene Dark Blue B O A & B G O	Brown	Violet	Violet	Violet	Unaltered	Red Violet	Red Violet	Blue
1177	Indigo M L B & B A S F	Olive	Yellow	Green	Green	Yellow	Insoluble	S. Green	Yellow
1182	Indigo M L B /R & M L B /R R	Yellow Green	Yellow	Green	Green	Reddish Yellow	Violet	Blue	Yellow
1183	Indigo M L B /2B	Yellow Green	Yellow	Green	Blue Green	Green Yellow	Insoluble	S. Green	Yellow
1184	Indigo M L B /4B Ciba Blue 2B	Yellow Green	Orange	Blue Green to Brown	Blue	Unaltered	S. Blue	Blue	Green Yellow
1185	Indigo M L B /5B Ciba Blue G	Yellow Green	Orange	Blue Green	Blue	Olive	S. Blue	Blue	Yellow
1186	Indigo M L B /6B	Yellow Green	Orange	Yellow Green to Brown	Blue	Unaltered	Blue	Green	Yellow
1191	Brilliant Indigo M L B /T	Yellow	Yellow	Green to Red	Blue	Colorless	S. Blue	Green Blue	Yellow
1189	Brilliant Indigo B A S F /4G	Light Yellow	Orange	Green to Violet	Blue	Colorless	S. Blue	Blue Green	Yellow
1200	Alizarine Indigo 3R & 5R	Green Yellow	Yellow	Yellow Green	Blue Green	Unaltered	Insoluble	Blue Green	Yellow
1200	Alizarine Indigo 7R	Green Yellow	Yellow	Green to Brown	Blue	Unaltered	Insoluble	Blue Green	Yellow
1200	Thioindone Pure Black R	Green Yellow	Yellow	Green Yellow	Blue	Brown	Insoluble	Insoluble	Insoluble
1201	Alizarine Indigo B	Green Yellow	Yellow	Light Tan	Olive	Unaltered	Insoluble	Blue Green	Yellow
1202	Alizarine Indigo G	Green Yellow	Yellow	Olive	Olive Green	Unaltered	Insoluble	Light Green	Yellow
	Alizarine Indigo 7 G	Brownish-Yellow	Reddish-Brown	Brown	Olive Green	Unaltered	Insoluble	Green	Yellow
1203	Helindone Blue 3 GN	Green	Tan	Olive Green	Bordeaux	Pale Violet	Blue Green	Blue Green	Green
	Helindone Blue 3 R	Grey Blue	Green-Yellow	Bordeaux	Blue	Green	Violet	S. Blue Green	Yellow
1115	Cibanone Blue G	Blue	Blue	Blue Green	Olive	Unaltered	S. Blue	S. Green	Dull Yellow
	Helindone Blue 3 G	Navy Blue	Grey Blue	Green Blue	Olive	Yellow	Insoluble	S. Green Yellow	Yellow
	Algol Blue F B	Navy Blue	Grey Blue	Green Blue	Olive	Yellow	S. Blue	S. Green	Yellow
	Eridan Printing Blue B	Blue	Blue	Violet to Blue	Blue to Green	Unaltered	S. Violet	S. Pink	Dull Pink

RED

Color Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
	Indanthrene Brilliant Pink R	Scarlet	Orange	Pink to Brownish	Bordeaux	Unaltered	Pink with Yellow Fluorescence	Insoluble	Insoluble
	Indanthrene Brilliant Pink B	Lighter	Yellow	Reddish-Brown	Unaltered	Unaltered	Insoluble	Pink	Pink to Yellow
	Indanthrene Pink B	Brown	Violet	Violet	Violet	Unaltered	Insoluble	Pink	Green
	Indanthrene Red B K	Scarlet	Violet	Brown	Orange	Unaltered	Insoluble	S. Yellow	Yellow
1162	Indanthrene Red R K	Yellow	Violet	Brownish-Violet	Brownish-Yellow	Unaltered	S. Pink	Orange	Green
1131	Indanthrene Red 5G K	Orange	Violet	Brown	Orange	Unaltered	S. Pink	Orange	Orange
1218	Helindone F Scarlet R	Brownish	Yellow	Brown	Violet	Unaltered	Pink	Orange	Orange
	Helindone F Scarlet G	Orange	Olive	Brown	Bordeaux	Unaltered	S. Scarlet	Pink	Orange
	Helindone F Scarlet B	Orange	Yellow	Brown	Violet	Unaltered	S. Pink	Pink	Orange
1228	Thioindigo Scarlet 2 G	Dull Pink	Blue	Violet	Brown	Unaltered	S. Pink	Red	Scarlet
1226	Ciba Red G	Dull Pink	Yellow	Yellow	Reddish-Brown	Unaltered	S. Pink	Scarlet	Brown
1211	Helindone Pink AN & BN	Brownish Pink	Yellow	Reddish-Brown	Violet	Unaltered	Pink with Yellow Fluorescence	Pink	Yellow
	Helindone Red R	Yellow	Yellow	Brown	Bordeaux	Unaltered	Insoluble	Pink	Olive
1128	Algol Pink R	Unchanged	Orange	Violet	Scarlet	Unaltered	S. Pink	Orange	Blue Grey
1155	Algol Red B	Violet	Red	Violet	Violet	Unaltered	Insoluble	Pink	Pink
1129	Algol Scarlet G	Yellow	Yellow	Brown	Brown	Unaltered	Insoluble	Yellow	Yellow
1229	Ciba Red R	Light Pink	Violet	Violet	Red	Unaltered	Pink	Scarlet	Scarlet
	Hydron Scarlet 3 B	Unchanged	Yellow	Bordeaux	Bordeaux	Unaltered	S. Pink	Red	Scarlet
	Hydron Scarlet B B	Unchanged	Yellow	Reddish-Brown	Violet	Unaltered	Pink with Yellow Fluorescence	Red	Orange
1209	Helindone Red B	Brown	Yellow	Brown	Violet	Unaltered	Pink	Pink	Brownish Pink
1133	Algol Red R	Violet	Brown	Violet	Reddish-Brown	Unaltered	Insoluble	Pink	Green
Mixture of 1133 and 1136	Algol Red 2G	Brown	Reddish-Brown	Bordeaux	Violet	Slightly Bluer	Insoluble	Pink	Green
1136	Algol Pink T R	Brown	Reddish-Brown	Violet	Unaltered	Unaltered	S. Pink	Pink	Olive
	Indanthrene Printing Red G	Brownish-Orange	Brown	Bordeaux	Reddish-Brown	Unaltered	S. Pink	Pink	Yellow
	Indanthrene Printing Red B	Yellow	Brown	Bordeaux	Reddish-Brown	Unaltered	Insoluble	Orange	Orange
	Sandothrene Pink B G	Yellow	Yellow	Brown	Violet	Unaltered	S. Pink	S. Pink	Brown
	Indanthrene Scarlet R	Violet	Violet	Violet	Violet	Unaltered	Insoluble	S. Pink	Pink
	Alizarine Indigo Red B	Red	Yellow	Brown	Red	Unaltered	S. Pink	S. Pink	Brown
	Alizarine Indigo Pink B	Light Pink	Yellow	Green	Violet	Unaltered	S. Pink	S. Pink	Brown
	Eridan Scarlet R	Brown	Violet	Brown	Violet	Unaltered	Insoluble	Orange	Orange
	Eridan Brilliant Scarlet B	Reddish-Brown	Violet	Reddish-Brown	Violet	Unaltered	Green Fluorescence	Pink	Scarlet

(Continued on page 93)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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CALENDAR OF COMING EVENTS

Council and Research Committees—
February 27—New York.
March 20—Boston.
April 17—New York.
May 15—Boston.

* * *

Exhibition of Color at the Museum of the Peaceful Arts, 220 East 42nd Street, New York. Starts January 2nd and continues several months.

* * *

Symposium of Color in Art and Industry. To be held in connection with the meeting of the Optical Society in New York, February 26th and 27th.

* * *

New York Section Meetings—
February 27—New York.
March 27—Paterson.
April 24—New York.
May 22—Paterson.

TENTH ANNUAL MEETING

SATURDAY AFTERNOON SESSION

We will have to hurry on to the next item on the program which is, "Starch in Textile Finishing," by Ira L. Griffin.

. . . Mr. Griffin presented his prepared paper. . . . (Applause)

Starch Products in Textile Finishing

By Ira L. Griffin
Southern Manager, Stein, Hall & Company, Inc.

THE reason that gentlemen prefer blondes is probably inherited, and dates from the early sixteenth century. A certain little white substance, which figures so vitally in our commercial life today, was then considered a royal luxury—a luxury to be used only for powdering the hair. Because this substance, Starch, was obtained from grain that was needed for food, its manufacture was in many countries prohibited. And so only royalty could boast of those snowy white blondes who first made the gentlemen sit up and take notice. The old monarch who shouted, "My kingdom for a horse!" was in no less a dilemma than the old queen who shouted, "My kingdom for a box of starch!"

From a hair powder to an indispensable commercial necessity is the history of starch during the last few centuries. Science, with its seven league boots, has depended on starch for many of its greatest human blessings. Although starch was actually known a century before Christ, only during the past century has it become so widely important to the human race.

Today starches are commercially produced from Corn, Wheat, Rice, Potatoes, the Cassava Root, from which Tapioca Flour is obtained, and the Sago Palm, producing Sago Flour. I will now discuss the characteristics and use of these various products and their modifications in connection with textiles, and will commence with the initial starching operation.

Importance of Warp Sizing to Finishing

Warp sizing has a more important relation to the finishing of goods than is apparent at first thought. Consequently, before going into the discussion of the various starch products, I am going to touch briefly on the relationship of warp sizing to finishing.

There seems to be lacking a method of co-operation between the buyer, manufacturer and finisher of cloth, which places a big responsibility upon the finisher. For instance, we will say that the buyer of a certain construction of fabric has been obtaining his goods from mill No. 1. When he is again in the market for these goods, he obtains prices from a dozen or more mills, who are equipped to produce the construction of cloth desired. For one reason or another, and perhaps particularly on account of price, he places his order with mill No. 10. These goods will be sent to the same finisher and the buyer will expect identically the same finish as was produced from the cloth of mill No. 1. The two mills in question will produce cloth of the same construction and the same weight, but there will no doubt be variations in the type of cotton, the type of starch used in the sizing, as well as other sizing ingredients, the percentage of stretch left in the warp yarn after sizing, and the temperature at which the warp yarn is dried. In addition to all these possible variations, there is another point, which until recently has been given little consideration, although of extreme importance. I refer to the weights of the squeeze rolls in slashers and the relation between the weights of these squeeze rolls and the depth of size penetration.

Therefore, since the first operation of finishing consists in removing the size put on the warps for weaving purposes, the materials used in this operation should be of interest to those who are asked to remove it. Unless the size is completely removed, difficulties may be encountered, such as uneven dyeing or a variation in the finish. Some types of starches are more easily desized than others. I believe much benefit would accrue to the buyer, manufacturer and finisher if some method could be adopted whereby the finisher could be informed of all possible details in connection with the material, which he is oftentimes called upon to convert from "a sow's ear to a silk purse."

Types of Warp Size

Today cotton warps are usually sized with either Potato or Corn Starch. Of the latter there are generally speaking two varieties: Thick and Thin Boiling. In the sizing of fine warp numbers Potato Starch is used almost exclusively and is recognized as the most superior warp sizing starch. Of the medium and coarser numbers, excellent results may be obtained from the use of Corn Starch of a suitable type. Sago Flour to a small extent is also used in the sizing of cotton warps when certain special dry finishes are desired.

Sizing of Rayon

In recent years the quantity of rayon and synthetic warp goods coming into most finishing plants has increased to a great extent. The sizing materials used on such yarns are different from those used on cotton, because the synthetic fiber, as you know, is entirely unlike the natural fibers. Glue, Gelatine, Starch and specially prepared products are used in the sizing of Rayon. The size product used should have the property of remaining liquid at low temperatures, and produce a flexible and elastic film. This film must be of sufficient strength to protect the filaments of the thread during the weaving process, and at the same time of a character, which may be completely removed by the finisher with minimum handling and without harsh treatment.

Notwithstanding the fact that products which will accomplish all the requirements of an ideal size material for Rayon and other synthetic yarns are being used, many mills have adopted a policy of including in each bale or package of cloth going to the finisher, cards which give the finisher the necessary information about the size content of the warp, and a brief description of the simple process by which it may be removed. I believe a similar system of co-operation between the manufacturer and finisher of cotton goods would prove mutually advantageous.

Methods of Desizing

Aside from the well known chemical sour, the desizing of cloth is usually carried on by the use of various enzymic agents. This method relies on the disintegration of the starch by enzymes, the starch being converted into a product or products which are soluble in water. The enzymes usually take some time to completely break up the starch in the yarn, especially in those cases where the size has penetrated deeply. However, these enzyme agents are preferable to chemical desizing methods, time and expense permitting, because of the fact that they cannot possibly injure the goods.

In discussing desizing methods, I believe it will be of interest at this time to mention a continuous desizing method used in France, but recently patented in this

country. To my knowledge this method has not as yet found use among the finishing trade in this country, but believe that a continuous process would be a great advance over the present method of desizing.

Materials for the Finisher

The textile finisher is called upon to improve the goods. That is his job. He may be asked to improve the appearance, to increase the weight of the goods, or to impart some special effect. Let us consider for a moment, therefore, the materials with which the finisher can work. Besides starches and starch products there are glues, natural gums, softeners, hygroscopic agents, and, of course, a long list of chemicals, weighters and fillers. However, this paper is confined to starch and starch products.

I mean to include in this category products such as Tapioca and Sago Flours, as well as Wheat, Corn, Potato and Rice starches, and their modifications. The value of these starch materials lies in their adhesive and stiffening qualities. When cooked up in proportions of one part of starch to about ten parts of water (by weight), a swelling takes place, a viscuous mass is gradually formed, and the resulting mixture forms what is known as a colloidal solution. This colloidal solution, when cooled shows the property of adhesion and stiffness. The farinaceous materials all have the same general properties. They vary only in degree. It is an interesting fact that the modifications of each of the starches and flours carry with them to a great extent the properties of the base material from which these modifications are made.

Corn Starch

Corn Starch is extracted from the kernel of Maize or Indian Corn. The grain is first steeped in water at a temperature of about 120° F. It is then crushed to an extent sufficient to release the germ from the rest of the grain. The germ containing oil is then floated off, after which the remainder of the grain is reground and the starch separated from the husk by a process of screening. The starch milk is then run upon inclined tables or troughs. The starch granules settle as the milk slowly flows toward the end of the trough, allowing the gluten and other impurities to float off with the water. The starch then removed from the tables and dried in its unmodified state is known as Pearl Corn Starch, or it may be ground or screened and produce Powdered Starch. Both of these grades are known as "Thick" boiling starch. As a general rule it may be stated that Corn Starch gives a brittle papery finish with little flexibility, but great stiffness.

Potato Starch

The better grades of Potato Starch are extracted from well matured potatoes. In some sections, Potato Starch is produced on a small scale and in a crude manner from potatoes which are not suitable for eating or seed, and termed as culls or cuts. Starch so produced is usually of very poor quality and lacking in uniformity. The process of extracting potato starch is somewhat more simple than is required with corn, and briefly consists of grating, screening, tabling and drying.

Potato starch excels Corn starch in its water taking properties, and has the character of being more fluid and slow congealing at lower temperatures. This characteristic aids in penetration and explains why Potato starch produces such a smooth and uniform surface on yarn or cloth. Potato starch gives about the same degree of stiffness as Corn starch, but the finish is much more flexible, although somewhat thin. The characteristics of most value in finishing are perhaps the highly lustrous and flexible film obtained from Potato Starch.

Tapioca Flour

Tapioca Flour is extracted from the root of the Cassava plant, which is principally cultivated in the Dutch East Indies. The roots are shaped somewhat like certain varieties of Sweet Potatoes, and when fully matured grow to a length of five feet. About twelve to fifteen months is the usual period required for full maturity. The process of extraction and purification of the flour is generally like that employed in the Potato starch factories.

Tapioca Flour of a high grade gives a very tough, flexible, and rather full finish. In the combination of these three qualities it may be said to excel all other starches for certain finishes. The film resists to a great extent the breaking in handling of the cloth, as is experienced with Corn; however, the luster is not comparable to Potato either in brilliance or transparency. Tapioca Flour seems to be the most adhesive of the starch materials. It has a natural stickiness which makes it valuable especially for buckram, combining work and the like. The water taking properties of the high grades are considerably better than Potato, and the medium grades comparable.

Wheat Starch

The production of Starch from Wheat is the oldest of the starch industries and the process is the most expensive and difficult one. Wheat starch does not possess the stiffening properties of either Corn, Potato or Tapioca—it is softer, but herein lies many advantages for the finisher. With Wheat Starch alone he is able to produce a pliable, mellow and full hand, and in conjunction with other starches, Wheat is of much value in stabilizing the finish.

Rice Starch

Rice Starch is probably the least used of the finishing starches and flours and is also the most expensive. Its high gloss giving properties bring it into the finishing plant for certain special work such as lace curtains, etc. It also has the property of producing the most dead white finish of all the starches, its film being the most opaque.

Sago Flour

Sago Flour is extracted from the pith of the Sago Palm, which reaches maturity in 10 to 15 years. The

Palm blooms only once, and is usually cut about the time of the development of the bud. At this period the starch contained in the trunk is at fullest maturity. The largest plantations of these Palms are to be found in Borneo. Unlike any of the other starches or Flour, Sago is tan in color, and this fact limits its use. However, for the finishing of colored goods requiring a full, tough, leathery hand, or as a carrier for clays and Talc, it has no equal.

Modified Starch

Many of the above mentioned finishing products are subject to various processes designed to make them thinner boiling, or to put this term in different words—to allow the starches to be used in greater concentration without increasing the body of the resulting mixture.

There are many names for these modified starches. The corn derivatives are known as "Thin Boiling" starches, the products made from potato starch are known as Swiss Gums, or "Soluble" potato starch. As stated before, the characteristics of these various thin boiling products are somewhat similar to the thick boiling products from which they are made. Their usefulness in finishing is primarily due to the fact that the finisher can get more starch per yard on the goods with these products. As you probably know Thin Boiling or modified starches are used widely for weighting. The Thin Boiling starches are also used in combination with the Thicker Boiling products to obtain certain special effects not possible by using either of these products alone.

Dextrine and Gums

Dextrines and Gums are thinner than the modified starches mentioned above. These products are manufactured from the powdered starches and flours by hydrolysis. The starches are hydrolized by heating at temperatures from 300° to 450° F. In order to speed the hydrolysis, various catalysists are used, and the pH, or hydrogen ion concentration is carefully controlled. The degree of dextrinization is determined; first—by the type of catalysists; second—by the temperature, and third—by the length of time the starch is exposed to the temperature. This dry conversion process makes products much thinner boiling than the modified starches, and at the same time cold water soluble in varying degrees. For the most part they have been converted so far that on cooling they no longer gel. Though the stiffening property is reduced the adhesiveness is greatly increased. However, gums and dextrines due to their lack of gel find use in those finishes where stiffness alone is not desired. Mixing dextrines with starch reduces the gel of the starch, and therefore the stiffness of the resulting goods. For some extreme weighting, dextrine is excellent. The main use of dextrine in the finishing plant is due to its ability to increase the hand or feel of the goods and to act as a binding agent. This is desirable in many finishes.

Glucose

Glucose is the final conversion product. In the United States it is made exclusively from Corn Starch, but in Europe it is also produced from Potato Starch. This sticky liquid does not gel at all and has the valuable characteristic of absorbing moisture. It is used in finishing to prevent harshness and brittleness and to some extent to increase the weight because of its water absorptive property. Glucose is widely used with dextrine in khaki finishing where the goods must be soft but have a heavy feel.

Summary

In addition to the characteristics of the individual products which we have discussed, much might be said about the advantages of blending or mixing two or more of these products. This is sometimes done in warp sizing, and is common practice with the finisher. Results obtained from such combinations are dependent upon many factors of a local, individual, practical and economic nature; therefore generalizing would be of little value.

Conclusion

I wish, in conclusion, to remind you that probably no other single product has in the last century been subjected to such varied use as has been starch. The human race should be thankful for this indispensable product—and I am truly thankful, for in addressing a gathering of this organization, whose members are so much responsible for the scientific progress in the textile industry, no other subject but starch could have enabled me to put up a stiff front.

President Wood: The hour is getting late. If anyone would like to ask brief questions we will ask Mr. Griffin to answer them. This was a very interesting subject and he covered it very thoroughly.

The next paper is, "Sodium Phosphate, its Manufacture and Use in the Textile Industry," by Mr. Shattuck, of the Swann Chemical Company. Mr. Shattuck, you have the honor of winding up the proceedings.

Mr. H. F. Shattuck: The subject assigned to me was "Sodium Phosphate, its Manufacture and Use in the Textile Industry." However, I shall limit my remarks to tri-sodium phosphate and its general uses in the textile industry.

. . . Mr. Shattuck presented his prepared paper entitled, "Tri-Sodium Phosphate, its Manufacture and Use in the Textile Industry". . . . (Applause)

Proceedings of the American Association of Textile Chemists and Colorists

Tri-Sodium Phosphate, Its Manufacture and Use in the Textile Industry*

By H. F. SHATTUCK
Commercial Research Department
Swann Research, Inc.,
Birmingham, Ala.

TRI-SODIUM Phosphate or T. S. P. as it is generally called in the trade is the normal salt of ortho-phosphoric acid—H_3PO_4. The crystalline product contains theoretically 12 molecules of water of crystallization and analyzes 18.6 per cent P_2O_5. Actually, however, T. S. P. analyzes about 19.0 per cent P_2O_5.

Phosphoric acid, soda ash, and caustic soda are the raw materials used in the production of tri-sodium phosphate. Let us digress a bit and describe briefly the manufacture of phosphoric acid.

Phosphoric acid is manufactured by two general methods, namely, the wet process and the pyrolitic process.

The wet process is carried out by the decomposition of phosphate rock with sulfuric acid followed by filtration to remove the precipitated calcium sulfate. The phosphoric acid is purified and concentrated.

The pyrolitic process in carried out in a blast furnace or an electric furnace. In the first type of furnace heat is furnished by coke aided by a hot blast. In the second type of furnace, electric current furnishes the heat. Phosphate rock, coke, silica and scrap iron make up the material charge in the electric furnaces. The products formed are phosphoric acid and ferrophosphorus, the latter finding its chief use in the production of steel sheets which find a large use in the manufacture of automobile bodies and fenders. The phosphoric acid is recovered by precipitation in Cottrell precipitators in the form of crude 75 per cent acid. The crude acid is purified and filtered.

The actual manufacture of tri-sodium phosphate from phosphoric acid, soda ash and caustic soda, takes place in two steps—first, the formation of a solution of di-sodium phosphate, and second, the causticizing of the di-sodium solution with caustic soda.

Step No. 1

In a large iron tank equipped with an agitator 7,000 pounds of soda ash are suspended in hot water or wash liquor from a previous batch. The phosphoric acid is then added at the surface of the soda ash suspension causing the liberation of carbon dioxide and the formation of the di-sodium phosphate solution. The solution is adjusted so as to be slightly on the side of mono-sodium phosphate, and boiling is continued in order to remove all the carbon dioxide. Mother liquor from a previous batch is added to reduce the specific gravity to about 1.40. The final solution contains the solids originally in the acid as well as the iron and alumina precipitated from the acid as hydrate, and the soda ash which remains undissolved.

The solution of di-sodium phosphate is filtered, the filtrate going to storage tanks at a temperature of 85°-100° C. The filter press cake, or rather sludge, is washed with water, the washings being used in a successive batch. The sludge is discarded as waste.

Step No. 2

The causticizing takes place in large iron tanks quite similar to those used for making the di-sodium solution. The solution of di-sodium phosphate is pumped from the storage tanks to the causticizing tank. A 65 per cent solution of caustic soda heated to 90° C is blown into the di-sodium solution followed by 1,000 gallons or more additional of di-sodium solution. A large amount of heat is evolved during the reaction, making it necessary to vent the tanks by stacks through the roof. After completion of the reaction the mix is adjusted to the equivalent tri-sodium phosphate solution. The solution is filtered while hot in a jacketed Kelly press as the solution freezes easily if it is not kept hot.

The filtrate is pumped to a common feed tank from which it is fed to the crystallizers. In the feed tank the temperature of the solution is regulated to produce uniform crystals in all the crystallizing units. The solution of tri-sodium phosphate passes through a jacketed and steam heated line to Wier boxes located at the head of each set of crystallizers. The Wier boxes regulate the volume of the flow to the crystallizers.

The crystallizers are the Swenson-Walker continuous type. The installation is capable of producing 175,000 pounds of crystallized T. S. P. per 24 hours. The crystals are discharged into a separating pan and thence to a centrifuge. The filtrate is stored in tanks and used in subsequent batches. The crystals of tri-sodium phosphate are centrifuged, conveyed by a drag conveyer and bucket elevator to the rotary dryer. The dryer temperature is fairly low, the dryer being heated with warm air forced through the dryer by means of a fan. The dry, warm crystals are cooled in a rotary cooler and finally screened to produce a finished product of fairly uniform size.

The dried and screened product is aged several days in piles of a definite height, after which the material is ready to be packed. Packing is done in 125-pound kegs, 325-pound barrels, and 200 pound bags.

USES FOR TRI-SODIUM PHOSPHATE IN THE TEXTILE INDUSTRY

Two important general facts present themselves with reference to the use of tri-sodium phosphate in the textile industry. They follow—

*Acknowledgment is made of the kind assistance given by Mr. Charles B. Ordway, Member of the Faculty, Textile Engineering Department, Alabama Polytechnic Institute, Auburn, Alabama.

1. The buffering action of T. S. P., high pH value, without the tendering effect of strong alkalis.
2. The emulsifying property of T. S. P.

The high pH value of T. S. P. is due to the following reaction which takes place as soon as it is dissolved in water. By the reaction one part of di-sodium phosphate and one part of caustic soda are formed.

$$Na_3PO_4 + H_2O \rightarrow Na_2HPO_4 + NaOH$$

The emulsifying value of tri-sodium phosphate is particularly apparent in the wet finishing processes for cotton. The cotton fiber contains natural oils, waxes and nitrogen compounds. Strong alkalis are often used in excess to saponify the oils and waxes and make the nitrogen compounds soluble. The excess caustic soda can cause a great deal of damage, particularly in kier boils. The damage is largely due to iron stains, sometimes called kier stains. It is a well known fact that hot caustic soda will react with iron and steel, forming ferric hydrate, the cause of kier stains. In addition to vegetable oils and waxes the cotton contains mineral oil and grease picked up during the manufacturing process. The caustic soda will not saponify such oil and grease. Tri-sodium phosphate, however, will emulsify the mineral oil and grease, without losing any of its chemical properties. The exact cause of the emulsifying power of tri-sodium phosphate is not known.

The saponification of the vegetable oils and waxes from the cotton results in the formation of a sodium soap. When used with hard water and caustic only the sodium soap changes to insoluble soaps of calcium and magnesium, which attach themselves to the fiber and are removed with difficulty by washing. If tri-sodium phosphate is added to emulsify the mineral oil it will also aid in the washing and rinsing operations by forming insoluble phosphates of calcium and magnesium, which compounds are easily removed by washing.

Specific Uses for T. S. P. in the Textile Industry

1. Boiling off cotton goods or raw stock in kier or open kettle before bleaching or dyeing in conjunction with caustic. The tri-sodium phosphate acts as a buffer to the caustic, as well as an emulsifying agent for the mineral oils and greases present. Piece goods in kier boils require ¼ per cent of T. S. P. together with required amount of caustic and other assistants preferred by the dyer.
2. Wool scouring on raw stock or piece goods, the T. S. P. emulsifies fats more readily.
3. Rayon scouring to aid in removal of knitting oils with soaps.
4. In dye baths where the water contains calcium and magnesium hardness, to aid in washing finished dyed goods, through the formation of insoluble calcium and magnesium phosphates.

Tri-sodium phosphate of the lowest possible iron content serves the textile industry best, low iron content means fewer iron stains, a fact pertaining particularly to cotton goods, and cotton and rayon mixtures when prepared for peroxide bleaching. Tri-sodium phosphate can be used in peroxide bleach baths to replace sodium silicate, and makes possibly a better finish when goods are dyed.

In describing the manufacture of tri-sodium phosphate, one step included the production of di-sodium phosphate solution. If the solution of di-sodium phosphate is crystallized, the resultant product finds particular uses in the textile industry. It seems fitting that a few of the uses should be mentioned in this paper. A few of the uses follow—

1. In the weighting of silk.
2. In the dyeing of silk and cotton mixtures to increase the take-up of the cotton, when the silk shade is full.
3. In silk degumming in order to increase the ease of rinsing after the boil-off.
4. In dyeing wool with acid colors to reduce the acidity of the dye bath.

President Wood: Would anyone like to ask Mr. Shattuck any questions?

Mr. Robert R. Gow, Jr.: I should like to know if you suggest the elimination of caustic entirely in your kier boiling by tri-sodium phosphate?

Mr. Shattuck: No, sir, I don't think you can. You have to supplement your caustic with T. S. P.

Mr. Harry R. Davies: May I ask Mr. Shattuck whether he has had any experience with the use of tri-sodium phosphate alone?

Mr. Shattuck: I have not.

SIXTY-NINTH COUNCIL MEETING

The Sixty-ninth Council Meeting was called to order at 11:05 A. M., C. S. Time on Friday, December 5th, 1930. Elvin H. Killheffer presided. There were present:

Prof. L. A. Olney.

Mr. W. H. Cady, representing the Rhode Island Section.

Mr. P. J. Wood.
Mr. H. R. Davies.
Mr. R. S. Wheeler, South Central Section.
Mr. Arthur Thompson, Piedmont Section.
Dr. Carl Draves, Philadelphia Section.
Mr. Arthur Brainard, Chicago Section.

The Secretary's report was read and approved as follows:

SECRETARY'S BALANCE SHEET
DECEMBER 2, 1930

Cash on hand 11/20/30	$ 125.40
Receipts November 20th to December 2, 1930, Incl.	
Applications 5 @ $5.00	25.00
1930 Dues 1 @ $5.00	5.00
1931 Dues 152 @ $5.00	760.00
Corporate Dues 3	200.00
Atlas Electric Devices Co. 11/28 4 Launderometers	44.00
Total	$1,159.40
Disbursements	
12/2/30 to Treasurer—General Fund	$ 800.00
12/2/30 to Treasurer—Research Fund	244.00
11/20/30 Check returned—Bank closed	5.00
11/25/30 Check returned—Bank closed	5.00
Cash on hand Andover National Bank	105.40
Total	$1,159.40

The Treasurer's Report and his accounting of the expenditures for the year 1930 were also read and approved.

Four Active members and three Junior members, as per the following list, were elected subject to publication:

Active Membership

Custer, Harry J., 6419 No. 11th St., Oak Lane, Philadelphia, Pa. Manager of Dyeing Dept., Concordia Gallia Corp., Allegheny Ave. and Boudinot Sts., Philadelphia, Pa.

Elphick, Cornelius E., 12 Dane St., Jamaica Plain, Mass. Finisher, Carl Stohn, Inc., Hyde Park, Mass.

Taylor, Hazel B., 17 Thorndike St., Lawrence, Mass. Chemist, Laboratory, Lower Pacific Mills, Lawrence, Mass.

White, T. Edgar, P. O. Box 339, Anderson, S. C. Dyestuff Salesman, Ciba Company, Inc., Greenville, S. C.

Junior Membership

Danahy, Arthur J., 37 Clark St., Lowell, Mass. Student, Lowell Textile Institute, Lowell, Mass.

Johnson, Norman A., 298 Pawtucket St., Lowell, Mass. Student, Lowell Textile Institute, Lowell, Mass.

Stone, Myra Spencer, 50 Hobson St., Lawrence, Mass. Laboratory Assistant, Lower Pacific Mill, Lawrence, Mass.

Dr. Killheffer reported for the Committee on Research elected at the last Annual Meeting that largely due to the efforts of this Committee the United States Institute for Textile Research had been established and Dr. Stratton, Past President of Massachusetts Institute of Technology, had been elected President of the new body. At the time that this committee was appointed it was voted to allow it to expend $1,000, but not one penny of the Society's money has been spent. With this in mind it was voted that the Council approve the Recommendations of its research committee that the A. A. T. C. C. take out a Life Membership in the United States Institute of Textile Research at a cost of $1,000 and a contributing membership at a cost of $100 for one year.

An invitation was read from the Philadelphia Chamber of Commerce suggesting that our 1931 Annual Meeting be held in that city. This, of course, could not be accepted as Boston had already been decided upon.

The Chicago Section was represented by Mr. Arthur T. Brainard who extended an invitation for the Annual Meeting to be held in that city in the year 1933.

Mr. Arthur Thompson of the Piedmont Section suggested that we keep in mind the City of Charlotte for the year 1932 for the Annual Meeting.

Dr. Carl Draves inquired whether the A. A. T. C. C. wished to be represented by an exhibit of the Museum of Peaceful Arts in New York. It was voted that the Research Committee be empowered to collect and tabulate such an exhibit representing the work that the Association was doing in standardizing fastness tests on various materials and any other matters of general interest which could be assembled in time for the opening of the exhibit which occurs early in the New Year.

Mr. P. J. Wood asked for consideration of the possibility of assembling an exhibit which would show all the activities of the Association and that would be of perhaps a permanent nature to be prepared in time for the Chicago meeting at the time of the next World's Fair.

It was voted to appoint a committee to study the entire situation, the committee to consist of three or five members to be appointed by the President.

Dr. Killheffer whose term of office expired with the Annual Meeting made a short speech thanking the Council and the Association in general for their co-operation during his Presidency.

The meeting adjourned at 12:35 P. M.

Respectfully submitted,

HARRY R. DAVIES, *Treasurer.*

Washing Fastness Tests*

By HUGH CHRISTISON
Chemist, Arlington Mills

IN beginning our work on washing tests, we started out along the same lines as our German and English friends. We specified certain dyes, the method of application and the details of washing. Work in this direction was done by co-operating mill and dye laboratories. The results, when assembled, showed a disconcerting lack

*Presented at the November 8th Meeting of the Northern New England Section.

of uniformity. We expected that laboratories doing a high grade of work would show more uniform results when they supposedly made the same dyeings and then tested them in the same way. It was then suggested by Wm. D. Appel of the Bureau of Standards that standard dyeings be prepared, carefully checked and then placed at the disposal of interested workers for a reasonable price. These dyeings would represent the four degrees of washing fastness. We expect to work along these lines also in the fulling fastness tests. Our idea now is to provide standard dyeings rather than promulgate specifications. Wm. C. Smith, our Bureau of Standards associate, started on these lines under the directions of the sub-committee. A large number of dyeings were made on worsted panama cloth made of half-blood stock.

The work was done at the Lowell Textile Institute. We first found what would be acceptable to the laundry interests and to mill men. The late Mr. Livermore was quite interested in helping and seeing the problem started along these lines in order that a concentration of soap and soda and temperature would be used that would be acceptable to the various interests in general. The mild soap solution adopted was 5 grams per liter of an 88 per cent dry soap, such as Ivory or Lux chips. For a more severe test we used in addition to the soap, 2 grams of anhydrous sodium carbonate. The committee saw fit to adopt blue colored dyeings for all our standards, believing that there is more blue dye made and used than any other color. We tried to select dyes that were well known, easily obtainable in standard strengths and that were made by more than one maker. We also tried to pick dyeings that did not change in shade but merely lost in depth. From hundreds of tests made, four were selected finally that represented as many degrees of fastness.

The dyeing selected finally as representing the best fastness was colored using Erio Chrome Azurole B, C. I. No. 720, dyed top chrome. This stood washing for eight hours using 5 grams soap and 2 grams soda per liter at 120° F. without losing appreciable in depth of shade. For the second standard, we chose Brilliant Milling Blue B, dyed acid. This did not stand the eight hour washing, but did stand the two hour soap and soda scouring. The third standard selected was dyed using Alphazurine A, C. I. No. 114, acid dyed. This was scoured using the plain 5 grams per liter soap solution without soda for two hours and stood fairly well. Alphazurine GG, C. I. No. 712, dyed sour, was adopted as the fourth standard. This stood scouring for ½ hour using the 5 grams per liter soap. We put in a fifth class all dyeings which do not stand the mildest treatment, 5 grams soap per liter at 120° F. Quite a few fell in the fifth class, for example, Indigotine and Acid Magenta. We hope the four dyeings will be acceptable to the dye makers and that they will adopt them in making their color card classifications. We were perfectly aware that there would be a demand in the trade for shortened or accelerated tests. Mr. Smith worked for us in this direction, but, when stronger solutions or higher temperatures than are encountered in practice were used, serious objections could be made.

Test 1—5 grams soap 88% per liter.
2 grams soda carbonate dry per liter.
8 hours in Launderometer @ 120° F.

Test 2—The same solution, 2 hours.

Test 3—5 grams soap 88% per liter, 2 hours.

Test 4—5 grams soap 88% per liter, ½ hour.

The samples should be rinsed free of soap using warm water and dried quickly.

Ques. What is meant by "plain soap"?

Ans. Ivory or lux soap chips in water. Neutral soap practically dry, containing 88 per cent actual soap.

Ques. Is there any difference in methods of dyeing? Is the acid washed out or left in?

Ans. The acid is left in. No attempt is made to neutralize acid that has not been washed out with water. The method of dyeing I don't think is important, the idea is to promulgate four acceptable standards of fastness.

Ques. Is the same relativity of fastness shown where successive short washings are used?

Ans. Yes, Mr. Smith checked that very carefully and standards show the same relative difference. It is a fact that no one is going to wash a garment for eight successive hours so that question was raised and very thoroughly gone into. You might assume that half an hour be the limit of one washing and the eight hours of washing then would represent at least sixteen washings.

Ques. Of the variation of tests of different laboratories, was there such a diversity? Did all tests differ when the dyeings were made in the individual laboratories.

Ans. They were all different. So, the conclusion that we came to was to hand out the actual dyed fabric and then, if a man found that he didn't get the result that he was supposed to, he knew that he was not doing them the same way as the committee worker did. I think it's a good idea to have a standard.

Ques. What steps would the manufacturer take to classify the colors according to this scheme as to bleeding if the color changed in shade slightly but did not stain undyed material? How would he describe it?

Ans. We don't know how to produce standards that would at the same time give 4 degrees of fastness to washing and 4 degrees of staining properties. From a

mill man's point of view there probably would be only two classes, either the color would be satisfactory or it would stain the undyed silk, cotton or other material. I suppose he'd let his conscience be his guide as to whether it stained or didn't stain. I think that the manufacturer's color cards as a whole are useful and truthful if you allow something for enthusiasm.

Ques. I wonder if the findings on the washing tests did not depend on the percent of shade. For instance, if 1 per cent or ½ per cent have been fast to washing and 3 not so fast.

Ans. Yes. That is the reason why we feel that we must have actual pieces of cloth for standards of comparison. Of course, we all know that if you have a red for instance and dye a pink, the washing tests might be very good, but, if you dyed a maroon it might be quite poor, so that in your color card, you would, for example, have to state that a 2 per cent dyeing stood washing tests 2 or 3 and perhaps a ½ per cent dyeing was in class 1.

SIXTY-THIRD MEETING OF THE RESEARCH COMMITTEE

THE sixty-third meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Read House, Friday morning, December 5th, at 11:30 A.M.

The following were present: L. A. Olney, Chairman; Wm. D. Appel, Wm. H. Cady, Harry R. Davies, Carl Z. Draves, Walter E. Hadley, Jos. F. X. Harold, E. H. Killheffer, Arthur R. Thompson Jr., R. S. Wheeler, and P. J. Wood.

The chairman reported the work done by the committee since the last Annual Meeting and outlined plans for the future.

The matter of standard methods for fastness which were considered sufficiently developed to be recommended as permanent methods was discussed and it was voted to make definite recommendations at the Annual business meeting for their adoption.

The standard dyed silk samples prepared under the direction of the sub-committee on Fastness of Dyed Silk were shown and considerable discussion followed in regard to them. It was thought by some of the members that perhaps the first and second and third and fourth of the series of four samples might be too close, with too wide a gap between the second and third. It was stated that the committee realized that this condition existed, but up to the present time they had been unable to find any dyes which represented the standard requirements any better.

The meeting adjourned at 12:30.

Respectfully submitted,

HARRY R. DAVIES, *Acting Secretary.*

The Process of Silk Soaking*

By DR. FOSTER DEE SNELL AND CYRIL S. KIMBALL

THE raw silk thread as it is wound from the cocoons consists of two filaments of fibroin bound together by an outer covering of sericin. In the treatment of silk for manufacture of silk goods the sericin is removed in the degumming or boiling off process, so that the finished silk thread consists entirely of fibroin. In some cases the silk is degummed before spinning and weaving but in many mills, especially in hosiery manufacture, it is desirable to allow the coating of sericin to remain on the strands of fibroin until after the manufacturing operations have been carried out. The sericin acts as a protective covering for the filaments that will be present in the finished product and at the same time gives the silk thread greater strength to withstand handling throughout the manufacturing procedure. The sericin coating is harsh and stiff so that when the degumming process is deferred until after the goods are made up, a preliminary treatment of the raw silk skein to soften and lubricate the fibers is necessary.

This is usually carried out by soaking the raw silk in a water and oil emulsion, usually containing soap as emulsifier, for from 16 to 24 hours at a temperature of approximately 90° F. The percentage of oil in the emulsion is usually only about one per cent and the concentration of soap is about the same so that the chief effect of the soaking is one of absorption of water by the silk which gives the desired softening effect. The oil is also absorbed and has been assumed to have a softening effect. The soap is used chiefly for stabilizing the emulsion and other agents may be used for this purpose. A second purpose of the soap is as a wetting agent. Alkali carbonates are often added either to counteract any free fatty acid formed from the soap and so prevent rusting of equipment, or to obtain additional softening effect.

The oils most commonly used are neatsfoot and olive oil. These are usually emulsified by olive oil or red oil soaps. Emulsions of partly saponified neatsfoot or olive oils are sometimes used, and the use of sulfonated oils, which are sometimes blended with mineral oil, is also common. There are a variety of proprietary compounds on the market made up from different combinations of these ingredients.

A considerable amount of work has been carried out recently at the direction of several of the leading silk manufacturers with the purpose of obtaining more basic information in regard to this process. As a result a number of interesting theories have been evolved which give a new and more clear cut picture of what actually

*Presented by title at the Annual Meeting.

takes place in the soaking bath and of the relative importance of the various ingredients present in the emulsion.

Experimental Methods

The methods used by these experimenters vary widely. In general, the different reagents are studied separately in their relation to the treated silk, but the softening effect on the silk is determined in a variety of ways. Measurement of the actual softening effect is difficult as a number of factors are involved. Hart[1] makes no attempt to actually measure the effect on the behavior of the silk caused by the soaking baths. He analyzes the baths before and after use and the silk after soaking and reports what materials are absorbed or adsorbed by the silk as a result of the treatment. Neville and Marshall[2] measure the hydration of the silk by means of a dilatometer and assume that softening corresponds to the amount of liquid taken up by the silk. A method used by Julius Kayser & Co. actually measures the behavior of the silk after soaking by testing the elasticity and plasticity of the tram. These properties are measures of the workability and pliability of the silk and represent the characteristics that the silk should possess after soaking.

Action of Soap

The action of the soap in the soaking bath has been found to be more complex than was originally thought. Hart's experiments, in which silk was soaked in a 2.25 per cent soap solution, have shown that something of the nature of a chemical reaction occurs between the sericin of the silk and the soap. Soap is absorbed from the solution by the silk and the sericin combines with alkali formed by hydrolysis of the soap to form a compound of unknown composition. This liberates free fatty acid from the soap which causes the alkalinity of the solution at the end of the soaking to be considerably lower than that of the fresh solution. The reaction apparently occurs very quickly as the acidity of the soap solution was found to be the same after 15 minutes soaking as after soaking for 10 days. The alkali-sericin compound is apparently partly adsorbed by the silk and partly distributed throughout the solution. The amount of sericin dissolved in the solution in this way was small, never amounting to more than one per cent of the weight of the silk. The amount of alkali combined with sericin from 20 grams of silk when soaked in this way was equal to 21.2 per cent of the total alkali available in the original bath. This does not represent the total amount of alkali that will combine with the sericin as the liberation of free fatty acid by the reaction represses further hydrolysis of the soap. When alkali as caustic soda is added to the bath, further combination of the sericin with alkali occurs.

[1]Ralph Hart, Ind. Eng. Chem. *22*. 980-3 (1930).

[2]Harvey A. Neville and Theodore H. Marshall—Paper at Cincinnatti meeting of American Chemical Society, September 8-12 (1930).

In commercial practice, the concentration of soap is rarely as high as 2.25 per cent so that very little sericin would actually be lost in the soaking bath in this way. The reaction would occur, however, in accordance with the amount of alkali present, either added as such or from hydrolysis of the soap. The formation of free fatty acid in the bath is of interest. Many manufacturers are very particular in specifying oils of low free fatty acid content for the soaking bath in order to prevent the presence of any acid on the silk when it comes from the bath. The content of free fatty acid is of course an indication of the quality of the oil and a low percentage may be specified for this reason. Hart points out that the quality of the oil cannot be held entirely responsible for the presence of free fatty acid on the silk. Using the 2.25 per cent soap solution he found that 1.33 per cent fatty acid is deposited, which is practically 10 times the amount usually present in soaking oils.

It is improbable that the soap adsorbed by the silk has any softening effect. Experiments in our laboratory in which the concentration of soap was varied have shown that different amounts of soap present in the soaking bath gave no differences in the pliability and workability of the tram after addition of sufficient soap to facilitate wetting of the silk. Any soap deposited in the silk would probably tend to increase absorption of moisture by the silk and thus increase the softening to some extent. Adsorbed soap may also act as a lubricant.

In our experience, the average commercial concentration in the soaking bath is nearer one per cent than 2.25 per cent. The experiments of Neville and Marshall as well as observations of our own, have shown that a minimum soap concentration in the soaking bath gives a maximum softening effect. A concentration of 0.25 per cent was found to give the best results in work of ours, and Neville and Marshall found that a similar concentration gave the greatest hydration, which they have assumed to correspond to softening. The stability of the emulsion is also affected by the amount of soap present, these smaller concentrations of soap giving the best dispersion. This may explain the increased softening effect with low concentrations, as a better dispersion would enable the silk to absorb more of the uniform emulsion.

Therefore, while it reacts with sericin and is adsorbed by the silk, the soap acts primarily as an emulsifier for the oil present rather than as the direct softening agent for the silk. In view of this, the concentration of soap should be that best adapted to stable emulsification and should be kept as low as possible in order to eliminate unnecessary action on the silk.

Function of Oils

In contrast with soap, the oil in the bath does not react in any way with the silk but is deposited on it, giving

a lubricating effect. According to Hart and Searell[1], 19.7 per cent of the neutral fat in the original liquor is deposited on the silk. They state that the action of the oil is entirely physical and mechanical. This agrees with results obtained in our laboratory in which we found that varying concentrations of neatsfoot oil in the bath showed no differences in effect on the elasticity and plasticity of tram.

According to Neville and Marshall, emulsions of soaking oil in which soap is the emulsifying agent cause a greater amount of hydration and greater gain in weight of the silk and also act more quickly than emulsions formed by the presence of sulfonated oil. Sulfonated oils, however, are commonly used in silk soaking. The best justification for the use of these oils is that a better oil dispersion is obtained so that a more stable emulsion is formed. The use of a small amount of triethanolamine in conjunction with sulfonated oils gives a very fine dispersion and is an improvement over the plain sulfonated oil emulsions. Its use does not cause as much hydration of the silk, however, as soap emulsions.

Effect of Alkalies

Alkali must also be considered as a factor in the soaking emulsions, either that formed by hydrolysis of the soap or as that added as carbonate or other alkali. Hart's experiments showed that a combination occurs between alkali and the silk gum. We have found that this reaction with the sericin is related to the softening effect as measured by elasticity and plasticity of the treated silk. When all other factors are kept constant and the concentration of alkali present varied, the plasticity increases with increasing concentration up to a maximum effect at a pH of about 10. Above this concentration, additional alkali decreases the plasticity.

The effect of the presence of a limited amount of alkali in the bath is therefore to increase the softening of the silk, and the addition of alkali is desirable for this reason as well as for its neutralizing effect on the fatty acids formed from the soap. According to our experience there are disadvantages which outweigh this advantage in the use of any considerable concentration of alkali. We find that although the alkalinity at the beginning of the soaking may be high, it is always reduced to a pH of 9.5-9.7 at the end of the bath, and that when the initial concentration of alkali is greater than pH 9.7 there is a counterbalancing tendency for the silk gum to become harsh. The presence of any large concentration of alkali also causes increased cream separation.

Cream Separations

The stability of the emulsion in silk soaking is an important factor which is often disregarded. Instability of the emulsion causes a thick layer or cream of partially coalesced oil droplets mixed with soap to rise to the top of the bath. Hart and Searell found that with a heavy cream separation, 60 to 65 per cent of the total neutral fat in the bath was present in this upper layer. Formation of this scum on the top of the bath is caused by instability of the emulsion alone and is not due to any reaction with the silk or foreign materials present. Our analyses of such scums have shown them to consist entirely of materials present in the original soaking bath. Nitrogen from sericin could not be detected. The amounts of calcium and magnesium salts present were very small, so that hardness of the water may be eliminated as a cause.

There are a number of disadvantages connected with this cream separation. It is reasonable to suppose that when such a large percentage of the oil separates out from the solution the effect on the softening of the silk would be noticeable. In an experimental determination Hart found a decided difference between the upper and lower layers of the bath in the amount of oil deposited on the silk. Commercially this difference is slight and the presence of cream separation does not materially affect the final softening effect. The serious difficulty caused by such separation of the emulsion is that some of the scum is apt to be deposited as a heavy layer on the silk. On drying out, such deposits become very sticky so that the skeins are difficult to handle during the knitting operation due to poor take-up of water.

Conclusions

On the whole, therefore, it is better to keep the alkali content low, depending mainly on absorption of the oil and water of the emulsion for the softening effect. Some alkali will always be present whenever soap is used, so that a part of the softening will be due to it. If the soap content is low, the formation of the alkali sericin compound will be at a minimum. Then any addition of alkali to counteract the formation of fatty acids may be correspondingly small. The resulting soaking emulsion will be stable and the maximum effect of the oil and water emulsion may be realized.

[1]Ralph Hart and George W. Searell, Ind. Eng. Chem. *22*, 984-5 (1930).

Giles Dyeing Machine and Its Application

By Donald M. Giles
Giles Dyeing Machinery Co.

MR. CHAIRMAN and Gentlemen of the Association: Through the kindness of Mr. Bertolet of your organization the privilege of saying a few words about the Giles Dyeing Machine and its applications has been extended to me.

Presented at the December meeting of the Philadelphia Section.

I understand from Mr. Bertolet that, like the apprehended criminal, "anything I say may be used against me" and that after my talk I am to be subjected to questioning by your members.

It seems to me that it would be better for you to feel free to interrupt me at any time so that we can clear up any doubtful points while they are fresh in mind, rather than to wait until I have finished my talk. I would ask you to bear in mind that I am no dyer and can only relate to you what users of our machine tell us in regard to their merits and faults. Inasmuch as I have no large illustrations, I have, at Mr. Bertolet's suggestion, provided you with some of our literature descriptive of our machines to which I shall refer during the course of my talk.

To go minutely into all phases of the application of our machine would undoubtedly be but the repetition of an old story to most of you, so that beyond a mere outline of the general uses of the machine, I shall confine myself to some of the newer phases of its application.

Our machines are used for dyeing and bleaching all kinds of skeins: cotton, mercerized cotton, wool, worsted, rayon and silk (both thrown and spun), linen, artificial horse-hair, visca, ribbons and many novelty yarns such as ratine, boucle, etc.

Giles machines are built in two general types, the "ferris wheel," or rotary type and the "small lot" or spindle type. The first and better known machine consists of a large reel upon which are mounted two circular series of dye sticks; the outer series being square, and the inner round—or octagonal. The skeins are held extended between an outer and inner stick, at proper degree

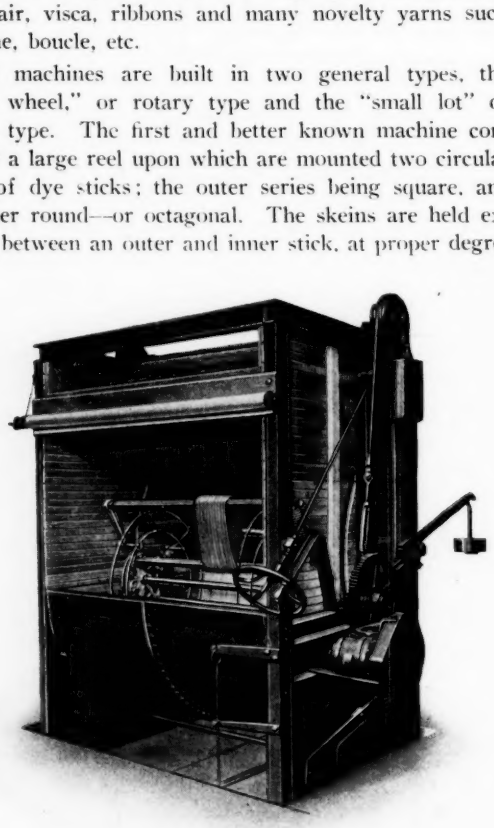

Fig. 1

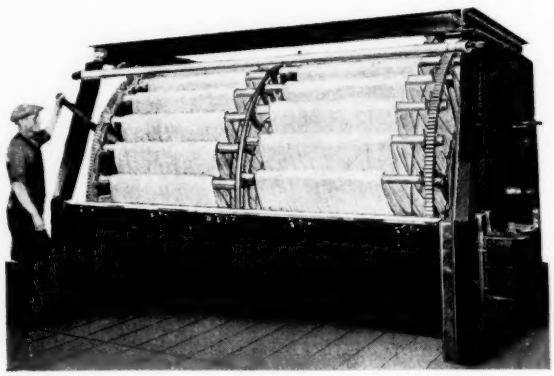

Fig. 2

of let us say "slackness," rather than "tension." This degree of "slackness" has an important bearing on the evenness of dyeing and yarn condition. If you will look on Fig. No. 1, you will see the method of holding the skeins. Fig. No. 2 shows how a fully loaded machine appears.

After the yarn is loaded into the machine, the reel or "ferris wheel," is slowly rotated, the skeins of yarn passing in and out of the bath as the reel rotates. Each square stick is mounted in a star wheel which, as the skeins reach a position where they hang vertical, is turned by a trip mechanism so that the stick is given a quarter turn which moves the yarn away from it, so avoiding stick marks.

The speed of rotation of the reel can be varied, it being customary to use a comparatively fast speed when the goods are first entered, and then to run at a slower speed during the rest of the process. It should be remembered that while speed has a tendency to give more even dyeing it has a bad affect on the windability of the skeins. Therefore, the best results are obtained when the slowest speed consistent with even dyeing is used.

This type machine is used for all kinds of skeins, the general operating principle being the same in all cases. Inasmuch as different materials are skeined on different sized reels it is necessary to alter the machine dimensions for handling different classes of yarns. Sometimes we make combination machines which have two inner rings, and which are fitted to handle a larger range of skeins sizes than do the regular machines.

For cotton, worsted and wool skeins, and materials which are not particularly avid for dyestuff, and which a comparatively active circulation, due to direct injection of live steam into the dye bath, will not damage, non-hoist machines are used, the dyestuff being fed into them through a distributing system while the goods are in the bath. These machines are well illustrated in Fig. No. 2.

For yarns such as mercerized cotton, which absorbs dyestuff very quickly, and for such materials as silk and rayon, which are readily matted by violent disturbance

of the dye liquor, hoist machines are made. These are shown in Fig. No. 3. In these machines the yarn is loaded on the hoisted reel, the dye bath is made up and the loaded revolving reel is lowered into the bath. When sampling, when making an addition, or when raising the temperature of the bath, the reel is again raised.

In cases where ready cleansability is not a paramount factor, or where a preponderance of metal is a disadvantage, plain wood tubs are provided, otherwise, tubs with a metal lining such as copper, lead or monel metal are used.

In hoist machines the weight of the reel is counterbalanced. In the smaller machines a hand hoist can be used. In the larger ones a power hoist is used.

In both hoist and non-hoist machines the trip is absolutely automatic, needing no attention at any time.

In hoist machines it was formerly necessary to throw the trip out of operation when hoisting or reversing the reel. Neglect to do this resulted in a broken trip mechanism.

Sticks are made of the materials best suited for each particular purpose. Plain wood, Bakelite enameled wood or Metallic sticks can be furnished. The metallic sticks are made of monel or of chrome plated brass. The chrome plated sticks are working out very nicely, being less expensive than the monel and more readily cleaned. I have here samples of the metal sticks. For direct colors on rayon the Bakelite enameled sticks are very satisfactory, but for vat colors they are useless as the caustic destroys both enamel and wood. It was for this reason that the metal stick was developed.

The rotary machines just described are of particular advantage for larger lots, and on account of the method

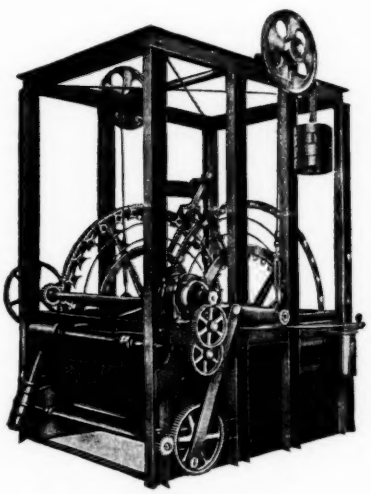

Fig. 3

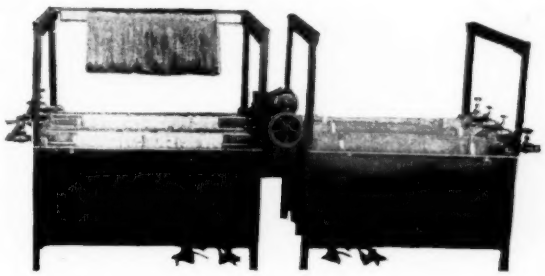

Fig. 4

of holding the skeins and because of the gentle manipulation of the yarn give unparalleled windability. The ratio of yarn to liquor in the larger sizes is about 1 to 18 and in the smaller sizes goes as high as 1 to 35. The flexibility for different size batches is not as great as in the spindle machines of which we will now treat.

These machines shown in Fig. No. 4 as built by us are similar in operating principle to the porcelain or glass spindle machines but are built in smaller units. The spindles are of monel and are removable and are taken in and out of the machine manually, as in our rotary machines. This method of construction eliminates the expensive power hoist and permits us to build the machine at a fraction of the cost of the porcelain and glass spindle machines.

The tubs are of steel, lined with monel metal, and can be provided with either permanent or removable partitions. For instance, in the eight spindle machine in Fig. No. 4, a removable partition is provided between each dyeing spindle. There are two tubs accommodating four spindles each so that one can dye two thirty pound lots of rayon or eight pound lots simultaneously in the same machine. By different arrangements of the partitions any size lots between can be handled.

The advantage of this type machine is that it is very flexible, and a reasonable liquor ratio (1 to 35) is obtainable for small lots. Its advantage over hand kettles is obvious, one man dyeing from two to eight lots simultaneously. Costs are always interesting, and in this connection Mr. M. A. R. Selisch, one of your enthusiastic members, and dyer for Marshall Field's Thread Mills Plant, Monticello, Indiana, has very kindly loaned me some samples of his work dyed on one of our eight spindle small lot machines. When the machine was first installed he made comparative test dyeings, in most cases 20 lbs. to a batch, first by hand and then by machine. The dyestuff used and the material cost, which includes dyestuff, and all chemicals appear on the tag attached to each skein. The figures appear for both hand and machine work and the pound cost is shown for each. You will note that the saving per pound approximates 10 cents. I call your attention to the fact that the dyeings by Mr. Selisch are

all vat colors and I now wish to say a few words about this branch of the art.

The idea has always pervaded the dyeing industry that machines of the rotary type were unsuited for the dyeing of vat colors, because of the liability of oxidation. In spite of this prejudice several well known dyers and mill dyehouses are using our rotary machines for this work on both cotton and rayon. I know that someone is itching to ask me how much more hydro we use in the rotary machine than in hand kettles. Under ordinary conditions 50 per cent more is used. Now let us see how this works out, to dye 220 lbs. of rayon or cotton by hand requires the following:

Hydro—16 lbs. at	.25	4.00
Caustic—24 lbs. at	.04	.96
Chemical cost		4.96
Labor 4 men at 6 hrs. each	.50	12.00
		16.96

In a 30 stick machine:

Hydro—26 lbs. at	.25	6.00
Caustic—30 lbs. at	.04	1.20
Chemical cost		7.20
Labor 1 man 6 hrs	.50	3.00
		10.20
Saving		6.76

Thus, while chemicals cost $2.24 more for the machine dyeing, the labor saving is $9.00 making a net saving of $6.76 for every case of rayon dyed, or about 3 cents per pound.

Another interesting comparison is that between hand and machine dyeing of rayon with direct colors. The labor is the chief saving. To dye a case of rayon (220 lbs.) by hand requires four men. On a Giles machine a man will dye the same amount. Assuming that in the dyeing of direct colors three batches per day is a fair average, then by hand the cost is:

4 men—5.00 per day.....20.00 to dye 660 lbs.

By machine:

1 man—5.00 per day..... 5.00 to dye 660 lbs.

a saving of $15.00 per day, or $4,500.00 per year in favor of the machine. Thus, by hand the labor cost is about 3 cents per lb. against less than 1 cent per lb. for machine work. We have had several instances where one man has dyed four to five cases (880 to 1,100 lbs.) per day. We are told that the finishing, or dressing, of machine dyed yarn is much easier and that the winding is vastly better. Asked about their winding, many customers reply that the only complaints they have are about hand dyed rayon.

In the above compilations I have assumed that hand dyeing takes the same period of time as machine dyeing. I am informed that three batches of vat colors can be dyed in two days by hand and four batches in the same period of time by machine. This makes a further saving of 33 per cent in favor of the machine.

I have here some samples of dyeings and of finished work done at the plant of E. L. Mansure & Company of this city, by one of your members, Mr. James Gray. These are vat dyed on Giles machines and speak for themselves.

I may state that the saving in labor and yarn condition is applicable in varying degrees to wool, worsted and cotton skein dyeing and to the dyeing of ribbons, visca, artificial horse-hair and fancy yarns such as ratine, boucle, etc. I feel that machines of the rotary type are the only ones suitable for the dyeing of visca and artificial horse-hair and other fibers of this nature.

In closing I think it well to mention some of the later developments in the engineering materials used in dyeing machines. Our old friend Monel Metal and its undoubted merits are familiar to all of you. The use of chromium as a plating is growing and I think its growth is due to real merit. Bakelite and other synthetic resins have not been used to any large extent and it would seem that they could be utilized for a great many things in the dyeing industry.

The so-called stainless chromium bearing irons and steels have not been used to any extent, probably due to the fact that they are not recommended for resisting sulphuric acid and chlorine. The present, however, a very interesting field for investigation. Where a metallic lining is objectionable it would seem that in a large number of cases glass lined tanks could be used. We have had quotations on these and they compare favorably in cost with Monel Metal. The use of temperature control can be studied with profit in a large number of cases. Substitution of metallic for wooden sticks is in many cases economy, and while I have no definite figures, the saving due to better yarn condition is vast.

Some time ago the writer ran across a cut depicting a dyehouse in ancient Egypt during the reign of King Tut and with the exception that the dye baths were heated by open flame and the skeins were wrung out instead of whizzed in a centrifugal extractor, there was virtually no difference between the mechanical methods of this ancient dyehouse and the hand kettle equipped dyehouse of today.

In view of the improved quality of work as well as the savings that machines can effect in the dyehouse how can we justify the continuance of antiquated hand methods?

Now Mr. Chairman, I wish to thank the various members of your Association for information they have given me in the preparation of this article. I also wish to express my thanks to the gentlemen present for their

interest and attention and your Association and to Mr. Bertolet for the opportunity given me to speak to you.

Question: On the tags attached to the dyeings (passed around for inspection) I notice differences in the labor required and the costs of the dyeings. Can you explain this?

Mr. Giles: These skeins were prepared by Mr. M. A. R. Selisch and sent to me. They were all dyed on a Giles spindle type machine. If I understand the question correctly you wish to know where the difference comes in between hand dyeing and machine dyeing. I believe this is almost entirely in labor although if you will examine the tags closely you will see there is some saving in chemicals and dyestuffs.

Question: What is the largest capacity of your machine?

Mr. Giles: The largest machine built by us is a 1,000 pound machine and for your information would say that the Mohawk Carpet Company dyed the worsted facing for a rug which when completed weighed 3,000 pounds. The facing was dyed in one lot of 1,200 pounds in one of our 1,000 pound capacity machines. The largest machine for dyeing cotton is also 1,000 pounds. For dyeing rayon we have never built a larger machine than 440 pounds.

Question: Are there any points of advantage in your machine which you would care to bring to our attention in comparison with others? I refer to the porcelain spindle machines.

Mr. Giles: The porcelain spindles are very expensive and require a large amount of floor space. The labor for dyeing a given quantity of yarn is considerably more than in a Giles machine as these machines require closer watching. I might state that the spindle type machines are excellent for the dyeing of a multiplicity of small lots but do not work as economically as the Giles machine for the dyeing of larger lots. The principle of operation of the spindle type is practically identical with that of our small lot machine.

At the last Knitting Arts Exhibition we ran yarn in both rotary and spindle type machines and found that it could be run at least four times as long in the rotary machine as in the spindle type machine. This is due to the fact that the handling of the yarn is very gentle and it does not get one-tenth as much manipulation as in the spindle machines.

Question: Can you work silk very much longer in the Giles machine?

Mr. Giles: Silk can be overworked in a Giles machine much longer than in the spindle type machines without unfavorable results.

Question: How are the spindles in your small lot machine kept in position?

Mr. Giles: The spindles are carried in a bearing at each end (demonstration given).

Question: Is there any danger of the spindle sagging?

Mr. Giles: The mechanism of the machine is such that there is no danger of this occurring. The yarn is prevented from running off the spindles by means of a guard wire, similar to that used in the rotary machine. This takes the place of the flanges used on the glass or porcelain rolls of other machines of this type and we find that the yarn distributes itself much better and cannot jump over the end of the spindle as sometimes occurs in the glass and porcelain machines.

Question: Do they sag as they get older?

Mr. Giles: No!

Question: Have you had success in dyeing cotton skeins in the rotary type machine?

Mr. Giles: The man next to you has.

Answer: (By gentleman referred to) Everything Mr. Giles has told you about the machine is true. For the past four years we have used the Giles rotary type machine for dyeing both cotton and rayon yarns with vat colors. We started with one machine; now we have three. We run these machines continually day after day.

Question: Can you give us an idea of the time the skein is in contact with the dye liquor?

Mr. Giles: You refer I believe to the rotary machine; the skein remains in the liquor approximately two-fifths of the dyeing time; the remaining time the skein is in the air.

Question: Is penetration good?

Mr. Giles: Yes! Very good.

Question: Please compare the running time of the Giles machine in comparison with others?

Mr. Giles: Suppose, for instance, we consider the dyeing of 440 lbs. of yarn. One man, operating our machine, can do this job in the same length of time that it would take four operators in open boxes.

Question: Is the speed of the machine greater at first?

Mr. Giles: The machine is usually run more rapidly when the dyeing process is first started, and is later slowed down by the operator. We have a drum controller which enables one to operate the machine at variable speeds.

Question: It seems that the cost of operating these machines would be high. Is this a correct assumption?

Mr. Giles: No! As mentioned previously our machine requires only one-fourth the number of operators required for open boxes. A trial of the Giles machine will give you an idea of the extent to which you can reduce your operating costs.

Question: What is the average time of loading your machine?

Mr. Giles: The total time is anywhere from 20 minutes to an hour to put the skeins on the sticks, depending upon the size of the load, and 10 to 20 minutes to put the sticks in the machine. Our machines are furnished with two

sets of sticks so that while one set is loaded and is in process of dyeing, the other may be in process of loading. In this way no time is lost.

Question: How does your machine differ from the Klauder-Weldon?

Mr. Giles: In principle they are approximately the same. Our machine is so constructed that there can be no back lash of the reel as it revolves. Also, our machine has a tripping device which requires no attention. We use a steel tub; they use wood.

Question: Can you regulate the turning action of the reel?

Mr. Giles: Yes! Our machine may be run at four speeds; some are equipped with four speed motors. I have explained previously that the machine is usually run more rapidly when the goods are first entered into the dye liquor. The speed of the reel is regulated by means of a drum controller of which I have spoken previously.

Question: Has it come to your attention that the chromium plated stick has more or less affect upon colors than other metals?

Mr. Giles: I might say that the sticks which were passed around for inspection were not polished for this occasion; they were from stock and are exactly as shipped to the customer.

It is well known that copper has its bad affects on some classes of colors. This is also true in a lesser degree of Monel Metal. So far as we have been able to determine chrome plating has less effect on the dye bath than the other two metals mentioned.

Question: Chromium plated sticks are much cheaper than Monel Metal are they not?

Mr. Giles: Yes! About one-third less. We find that chrome plate does not collect a deposit on it as does Monel Metal, but chrome plate stays bright in use and our customers have been very pleased with it.

Question: Is chromium plate fairly resistant to acid and chlorine?

Mr. Giles: We have had no experience with regard to this as up to date chrome plated sticks have only been used for the dyeing of rayon where the chemicals mentioned are used but infrequently.

Question: Have you noticed differences in the chromium plating jobs?

Mr. Giles: Yes! There are different ways of plating with chromium.

Steel is usually copper or nickel plated, and then a top plating of chromium is applied. A good job is expensive.

We have been equipping our machines with chromium plated sticks for about a year.

Question: What is the metal on the market known as Allegheny metal?

Mr. Giles: It is a composition of nickel, chromium, and iron and should be satisfactory for use in reels. We have not used it to any extent for the reason that the manufacturers do not recommend it as a resistant to sulphuric acid in any degree of concentration.

Question: Have you ever tried tantalum?

Mr. Giles: No. It would seem to me that this material is too expensive to even be considered.

I might add that many people are using chromium plate for printing rolls.

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AMERICAN DYESTUFF REPORTER

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Professor of Chemistry and Dyeing, Lowell Textile Institute
Directing Editor

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IN TIME OF UNEMPLOYMENT

IN AN attempt to spread employment and earnings as far as possible, most companies faced with the need of curtailment have shortened the working time of the individuals in the departments of the plant affected. This is only an emergency procedure and has met with widespread acceptance by employees who realize the necessity of such a step. The advantage of keeping the help you have spent time in training is self-evident. In many cases it is sufficient to merely eliminate overtime work. Extreme cases sometimes require a half-time schedule for the employee. In such instances many companies have, to the extent necessary, suspended deductions from pay for savings, stocks or similar plans to give men on half time the immediate use of all pay earned.

In a period of depression, rather than cut down on hours of labor or discharge employees, it is sometimes better to take advantage of an opportunity of doing much needed repair work about the plant. When a plant is producing at capacity speed, it is a costly proposition to cease operations in order to make repairs. In addition to routine cleaning, repairing, testing, painting and replacement of old machinery there is also the possibility of construction to increase the work available around a plant.

In any case where a lay-off procedure must go into effect, a complete personnel survey should be made. Hit-or-miss lay-offs are poor enough policy at any time, but when serious unemployment is general, they are entirely unwarranted. The best procedure can only be established on the basis of complete up-to-date knowledge of the economic status of the personnel concerned. Such an action will serve the following purposes: It will disclose persons willing to take vacations without pay providing they are assured of future employment. It will show how many wage-earners from one family are in the company's employ. It will determine the need for earnings as indicated by home responsibilities. Some persons may be revealed who are willing to accept reduced pensions immediately. A priority list can be made out for preferential re-employment.

Progressive companies who have found it imperative to drop men have seldom dropped all concern for their former employees. They have found that trying to help men whom they have permanently laid off, either by placement or financial assistance, has worked to their advantage. In the first place, the man let out has a better feeling toward the concern; in the second place, it does much to build up the morale of the men that are kept on.

Of course, all the above discussion is for a temporary policy. In the long run, unemployment must be taken care of by forecasting and planning. By which is meant such things as marketing research, broader training of new employees, standardization of products and the like.

INCREASED WAGES?

WHILE the depressing wail of "overproduction" continues to pass as the complete explanation of the present world-wide industrial depression, it is interesting to consider the views of certain modern economists who believe that lack of buying power is as much, if not more, the fault of today's conditions as overproduction. Continuing further, they point out what they consider to be the fallacy of plastering the country with "Buy Now" posters, when the vast multitudes actually haven't the cash to purchase, no matter how alluring may be the bargain prices of today. They maintain that increased buying power would immediately be felt in increased purchases, and that it would not be long before the wheels of industry would be turning as merrily as before. "Have vision," they say in effect to American Industry, "do not practice the false economy of decreasing wages. That is the old, hackneyed method of slow recovery. For quick recovery, increase wages!"

This view is interesting and certainly worthy of consideration. There is no denying that a man earning say, $50 a week, suddenly finding an additional five dollars in his pay envelope, would soon be converting it into a "down payment" on new clothes, a new radio, a new ice box, a new automobile or whatever commodity or luxury he had been denying himself. Moreover, the psychological effect of even a small wage increase would be tremendous. Buying confidence, that elusive and intangible unknown quantity, so necessary to prosperity, would probably return.

SCRAP AND BUY

A DRAG on business in many manufacturing plants today is old, wornout machinery. Much of it is obsolete; it creaks in protest while it runs, as though conscious of its own inefficiency. Compared with modern apparatus it consumes so much power and labor that in every hour of its operation it shaves fractions from profits. Repairing such equipment only would add to the expense of its operation. The unlucky workers who man this machinery, moreover, often lack the morale of their fellows employed on newer equipment. Aware of the extravagance and of the shortsightedness of maintaining a factory below maximum efficiency, regardless of its daily running time, they lose respect for the management's business ability. To weaken the spirit of any plant's manpower in that way is unsound business policy.

With business slack and with many plants operating on short schedules, old machinery can be discarded now without disrupting production. No more propitious time, indeed, may come again for many years. In this way industry should use profitably the present opportunity to prepare for the productive period sure to follow return to normal conditions. When buyers have cleared retail shelves, thus creating the demand for new stocks of merchandise, those plants that are caught with obsolete machinery will learn a costly lesson. Now is the best time to scrap and buy.

CLAYTON HOAGLAND in *New York Sun*

EXTRACTORIALS

Resolve to fight the inside competition before going after the outside competition. More often there is more to be done in one's own plant than there is in fighting the outside competitor. Inefficiency of employees is often a result of their not knowing how to plan and manage the details of their work—help along the line of instruction to raise the efficiency of the employees will pay dividends.—*Starchroom Laundry Journal.*

It is a certainty that America wishes to retain its high standard of working and living, its luxuries that are now necessities, its hygienic packaged products, its comfortable work shops and homes, its swift transportation and good roads, its sound pictures and radios, its educational and charitable institutions. All of these desirable things are fostered by business-created wealth which would not be possible without advertising.—*Joseph H. Appel in Editor & Publisher.*

For we believe very definitely that 1930 was a transition year in textiles; transition between loose thinking and clear thinking. We believe equally confidently that 1931 will be the first full year when the results of that accomplishment may be conspicuously forthcoming in this field.—*Textile World.*

Exhibition on the Science and Art of Color

The great advances recently made in the use of color in Dyes and Dyestuffs are a feature of the Exhibition on the Science and Art of Color which will be given by the Museum of Science and Industry of New York at its headquarters in the Daily News Building at 220 East 42nd Street from January 20th to March 15th.

"The Exhibition is the first comprehensive effort yet made to indicate the use and future possibilities of color in virtually all departments of modern life and will bring to the general public and the technician a better understanding of both the scientific and artistic aspects of color," Professor Charles R. Richards of the Museum staff announced.

Many of the latest discoveries in the color fields, never before made generally known to the public, such as photography of ranges of color invisible to the human eye and hitherto declared "unphotographable," and machines which may ultimately displace the erratic color sense of the human eye, are on display at the Exhibition.

The Exhibition is held in collaboration with leading American scientists, artists, technicians, engineers and educators and is open daily without charge, from 10 A.M. to 5 P.M. Exhibits range from colored kitchen utensils and other articles in the home, to clothes, decoration, reading material, food products, color in transportation, manufacturing and industrial processes, and give glimpses of the kaleidoscopic cities of the next century.

In addition to numerous exhibits of color arranged by the Museum itself, more than two hundred outstanding scientific, industrial and business organizations make displays. Individual exhibits number in the hundreds, ranging from the scientist's spectroscopic and intricate color producing machinery to colored articles in daily use.

"Because of the profound effects which color and its wide use may contribute to our lives, and the general appeal to all which color makes, the Museum has undertaken to demonstrate to the public the great scientific and artistic advances recently made," Professor Richards stated. "For the first time, color will be presented not only from any one standpoint in a single field, but from the inclusive standpoints of the scientist, the artist, the psychologist and the technician, and an endeavor made to correlate them. The Exhibition will provide an opportunity for the general public to view concrete examples of the amazing range and diversity of color uses, and to see color processes rarely available outside the walls of laboratories and in complicated technical industries."

In asserting that we are probably on the threshold of a new era in the use of color, Professor Richards voiced the opinion that "this third decade of the twentieth century might be characterized by future generations as the real beginning of the age of color."

The Effects of Research on the Future of Industry*

By **DR. JOHN JOHNSTON**

Director of Research, U. S. Steel Corporation, Kearny, N. J.

IT WAS with considerable hesitancy that I accepted the invitation extended by Lehigh University to talk to such a distinguished audience on the topic allotted to me; and this hesitancy has not lessened as this date approached and the realization was borne in upon me that the subject—The Influence of Research upon the Future of Industry—implies some degree of prophetic ability. And yet by its nature the course of research defies prophecy and hence its consequences cannot be predicted; for if we know just where and how a research is going to lead us, we need not do it at all. In this connection it may not be amiss to point out that any investigation must be carried on with a reasonably open mind if it is to lead to permanently successful conclusions; for otherwise one is apt to find what one is looking for, to have one's prejudices confirmed and thereby to attain to, at best, only a part of the complete truth.

The most promising method of approach to the subject therefore is to make a brief general survey of the growth and status of industrial research in an effort to discover its trend; this trend, if it prove to be in a fairly definite direction, may then be used with some confidence to predict its probable course in the immediate future.

I shall confine my discussion to the apparent happenings in this country; but it must not be forgotten that science is international; that a great deal of the research achievements of American industry have been—and will continue to be—based on investigations and discoveries made in other countries, and that some of these foreign discoveries may have a profound effect upon our own industrial conditions. In any case the trend in the other highly industrialized countries is undoubtedly in the same direction as in the United States; the industrial revolution going on about us is world wide, though proceeding at widely different speeds in the various countries.

Before proceeding, we must agree upon a definition, for our present purpose, of just what we mean by research. Its common use extends over a wide range of varied significance, from the purely scientific investigation and technical and industrial applications of science, through routine testing, inspection and tabulation, on to research on sales, advertising and other psychological questions. I have no quarrel with any of these uses of the word provided its precise significance is made clear; in order to do this in the present discussion I propose to limit it to the influence of the conscious application of physical science on the development of industrial processes. The term industrial processes is used advisedly, as the use of the word industry would tend to broaden the treatment by the inclusion of economic factors—such, for instance, as would be involved in a discussion of methods of distribution—which I would be more hesitant to talk about here. This limitation is in no wise to be taken as implying that the other aspects of research are without considerable influence on industry; though I venture the opinion that revolutionary changes in industry are, in the immediate future, far less likely to flow from these sources than from a continuously broadening ordered application of the principles of physical science. And for this there is, to my mind, a quite definite reason, namely that research in physical science is in general objective and unemotional and leads to results which may be checked by anybody, and when adequately checked are true for everybody; whereas in many other lines it is subjective and tangled up with emotional preconceptions, and therefore leads to conclusions which are not generally accepted—indeed in some cases even the fundamental principles are still in dispute.

Within the field thus limited, the word includes work ranging all the way from the enthusiastic pioneering investigations of an Einstein, a Rutherford or a Pasteur to the rather uninspired, frequently unenthusiastic, degree-hunting dissertation of the average candidate for the Doctor of Philosophy degree; from a high search for new principles as guides in extending frontiers and exploring unknown regions—as, for example, the classical work of Willard Gibbs with its profound influence upon chemistry—to a filling in of small details on a map well along towards completion. But this is a difference of degree, not of kind, and all of it is necessary; for it is clear that a very great deal of what may almost be called routine research must be carried on as a means of elucidating specific details, this being inescapable particularly in industrial research. There is of course no real difference between "pure" and "applied" research, except in the main motive behind it; in either case, unless the investigator is impelled by a lively curiosity as to the inwardness of things and finds joy in satisfying this

curiosity, he is unlikely to achieve very much no matter what his nominal motive may be.

A fairly sharp distinction, both in method and result, may be drawn between this and what is not infrequently dignified by the more fashionable name of research, particularly in engineering and industrial laboratories, but is more properly termed routine testing. In the one case, the aim is to analyze the problem to set up experiments which will yield definite answers to specific questions, and so be enabled to disentangle and determine the influence of each of the several possible variable factors; with such knowledge one is in position to control the process in question at will, to change it from an art into a reasoned procedure, and so to secure the most economical operation and the best yield of which the process is capable. In the other case, it is tacitly assumed, or hoped, that the accumulation of results from routine tests—usually carried out in a conventional way—will lead to valuable discoveries; but this is, on the whole, unlikely. Routine analysis, testing and inspection is of course quite indispensable in industry, where it has amply repaid its cost, but this cost should properly be charged against operation, instead of against an appropriation for research except in so far as such routine testing is an essential part of the investigations. This distinction between research and routine is not usually made, particularly in citing as to the staff employed, and the money spent, on industrial research; such figures may for this reason be somewhat misleading. The work of some industrial laboratories is almost wholly research, of others almost wholly routine testing; such differences account in part for apparent disparities in productiveness and usefulness, and, if not taken into account, render comparisons between laboratories of doubtful value. As an over-all average it seems probable that not over one-half of the staff in, and expenditure upon, industrial research laboratories should properly be charged to research, as defined above, and to development. On this basis, by reduction of its apparent cost, industrial research gives a still better return.

In considering the number of industrial research laboratories, and their estimated annual cost, we should bear in mind the distinction just outlined, even though no hard and fast line can be drawn; it serves to cut down the number of laboratories and men which can properly be regarded as research laboratories and research men, and to lessen the apparent expenditures upon industrial research work. This last may however be offset by the fact that in the aggregate a good deal of investigation is done—usually in a rather unsystematic ineffectual way—in industrial plants which have no laboratory; but this kind of investigation is undoubtedly decreasing in relative, if not in absolute, importance as the value of systematic continuous work under the better control possible in a laboratory becomes more widely recognized. In considering the growth in the number of laboratories and men employed, the distinction adverted to above, is of less significance, and cannot in fact be made on the basis of the available information; it seems likely however that the trend towards research work is considerably greater than the mere figures for successive periods would indicate because in most industrial laboratories the relative status of research improves with age.

At the beginning of the century the number of industrial laboratories in America which could with any propriety be termed research laboratories, could be counted on the fingers. By 1910 several of those now most widely known had been started, but the total number was undoubtedly less than 100, no definite figures being available. With the next decade it began to increase rapidly at a rate accelerated greatly by the War, and in 1921 was in excess of 500, according to a census conducted by the National Research Council. A similar census in 1927 showed a total of about 1000 laboratories with an aggregate number of employes of the order of 20,000; and it is reasonably certain that the number of laboratories is now nearly 1500. It is believed that the total number of employes and the aggregate expenditure on industrial research are increasing relatively more rapidly than the number of laboratories. These items for individual concerns now range from about 5000 employes and $20,000,000 yearly downwards, there being undoubtedly a considerable number of companies whose annual budget for research and development is in excess of $500,000. Incidentally it may be noted that the annual cost of an industrial research laboratory is on the average between $4000 and $5000 for each employee on the staff, counting everyone down to and including the clerical and janitorial forces; and that of this amount about two-thirds is for salaries, the other one-third covering the cost of all the other items, such as rent, equipment, apparatus, power, etc. On the foregoing basis the aggregate annual expenditure was of the order of $100,000,000 in 1927 and has now considerably exceeded this huge sum, which is beginning to be comparable to the national expenditure caused by, and in preparation for, war.

This expenditure is for a relatively new, and more humane, warfare, a warfare against ignorance of the potentialities of our surroundings and for a better use of our resources, a warfare which piles up permanent credits instead of permanent debts.

The growth in the number of laboratories has been accompanied not only by a growth in the average number of employes but also by a steady betterment in the average quality and competence of their personnel. This betterment has occurred, in a sense, at the expense of universities and other academic institutions; but the net effect is undoubtedly good, as the development of industrial research has, by employing so many men, resulted in a greatly increased number of graduate students and in a very much enhanced published output of scientific research. Of this output the fraction contributed by men from in-

dustrial laboratories is steadily growing, both in amount and in significance; and there is good ground for believing that some of the outstanding fundamental discoveries of physical science will in the future be made by scientists in the employ of industry.

Laboratories tend to grow in size and few of them, if once properly established, are discontinued; there is therefore every reason to believe in a continued increase in the expenditure and personnel devoted to research and development by the industries of the country. The rate of growth may not continue to be so rapid as it has been doing the last few years; but I venture to believe that its growth is more likely to be limited by an insufficient supply of the proper kind of trained men than by any other single factor. The supply of men is a problem for institutions of learning and the industries together, a problem so recent that its solution is still a matter of experiment. In this connection, may I express the belief, now widely held, that the aim of the teacher should be to evoke in the student contemplating a career in research a comprehension of the fundamental principles, rather than to supply him with information as to practical applications, of science.

Now let us consider in a summary way the extension of industrial research in relation to the type of industry. Perhaps the pioneer was Edison who discovered a method of invention—and it is possibly the most significant of all of his many inventions—the essence of which is to assemble suitable staff and equipment, and to proceed to study the problem and discover by trial the ways to surmount its difficulties. After him, it started with the electrical industry which is a new industry, founded directly on science and led largely by men with scientific or technical training. It spread into what might be grouped as the fine chemical industry, using this term in a broad sense, extended more slowly into the heavier chemical and metallurgical industries and most slowly into the most ancient arts. In general it spread from the newer industries, based initially more directly upon science, to the older industries whose technical processes were conducted on a basis derived from the experience of generations; this basis sufficed so long as the old product continued to satisfy the customer but became unsatisfactory with the advent of higher requirements and more rigid specifications—caused largely by the increased substitution of machines for men—and of increased competition of other materials which serve the same purpose, possibly more effectively. It may not be amiss to point out that some of the industries which during recent years have been making the poorest return on the capital invested—such as the coal industry, the textile industry, the railroads—have so far done very little research, in any interpretation of the word; which is cause and which effect; or whether both are symptoms of lack of progressive management, I shall leave to you.

It would seem therefore as if most industries, and probably all large industries, were going to be forced by circumstances into research, either in order to hold their own relative position or because it offers possibilities of appreciable economies. That it does in fact achieve large economies if given a proper start and the right kind of staff, adequately supported, is another argument for believing in its extension. Some years ago one large company, after a very careful analysis, concluded that the *direct* returns from their research work were ten times its cost, over a period of years, this summation taking no reckoning of indirect returns, difficult to evaluate, which they believed amounted also to a very considerable sum. This return is probably higher than the usual experience; but such information as is available indicates a return ranging from 100 to 300 per cent of cost, this return tending to increase with the age of the laboratory. But such figures do not tell the whole story; for certain industries would have ceased to exist if they had not insured themselves by research against obsolescence, or supersession, of their art through competition. And this type of obsolescence of an art, or its replacement by another—which may be far from apparent as a future competitor—is likely to happen more frequently than in the past, merely because of the increased attention everywhere being devoted to such possibilities.

A list of the outstanding recent achievements which have been made possible by systematic research would be so long as to be wearisome. Many of these instances are already well known to you, and so I shall limit myself to a very few cases as instances of the profound effect which such achievements may have upon the lives and fortunes not only of ourselves but also of people living on the other side of the globe. The most obvious example is perhaps the vogue of electrical communication of intelligence—perhaps we should say rather, of pounds—brought about by improvements in the long-distance telephone, the radio and the cognate advance in sound-reproduction which made the talking movie possible. The use of rayon, a silk substitute made from wood-pulp or other sources of cellulose, has lessened the demand for real silk and so has profoundly affected the prosperity of Japan; and it seems not unlikely that further development of this type of material will affect the wool grower all over the world. The linseed oil industry and the paint industry generally have been affected by the widening use of lacquers made from cellulose derivatives; and it is of interest to note that these lacquers were developed incident to an effort to find a use for large quantities of butyl alcohol, produced as a concomitant of a new process, developed during the war, for making the necessary supply of acetone by fermentation of corn. The influence of the substitution of one metal or alloy by another of a metal by a synthetic resin such as bakelite, of leather by

artificial materials, and of many similar instances, has had such wide ramifications that it would be no easy matter to follow them through. The successful fixation of atmospheric nitrogen has revolutionized the situation all over the world, but especially in Chile; and the effect upon Chile would have been worse but for the development, by systematic research, of a new process for attracting the sodium nitrate which doubled the yield previously secured. There are indications of the birth of a huge industry which, using coal as raw material, will convert it by means of catalytic processes into oil and into a whole host of chemical substances which now are produced in wholly different ways; with influences which are now incalculable. It may be mentioned, as illustrating the interrelations of research that one of the main obstacles in the economic realization of the possibilities just adverted to, is a metallurgical one, far from easy to surmount—namely, the provision of a metal capable of withstanding the very severe conditions of temperature, pressure and chemical attack to which the containing vessels in such processes are exposed.

It may be noted that some of these instances—any others might be adduced—involve the replacement of one material by another. In earlier days, not so long past, such substitutes were apt to be imitations, stated by the seller to be "just as good" but found by the user to be inferior; and the matter was not infrequently tainted with fraud. But the typical modern substitute is either the identical material made synthetically—in which case it is usually purer and better than the natural product—or it is something which, making no pretence of imitating the appearance of the original, fulfils the purpose better or more cheaply, or both. The increased use and usefulness of substitutes reflects a change in attitude on the part of both maker and user; in bringing about this change, and in getting rid of many worthless imitations the work of the research laboratory has played a large part. In other cases improvement in the article has proceeded so far that we have in effect a substitute for that of a few years ago; for instance, the rubber tire which through developments in its compounding is good for a considerably higher mileage than was the case a decade ago.

In adducing the foregoing instances of achievement which without research would not be possible, I do not wish to convey any implication that they resulted solely from work in American laboratories, or that they necessarily originated in industrial laboratories. Such achievements cannot in general with propriety be attributed to any nation or group; they are brought about through application of the whole body of scientific knowledge, an international, growing, domain secured by the efforts of countless workers in various types of institutions in many lands.

That the influence of research—of a conscious search for new and improved methods, processes and products—is likely to become both more widespread and more profound follows also, I believe, from the fact that this method of invention, by a staff employed for this express purpose only, is so young. It is true, of course, that some results of research have for a long time been made use of, some of them indeed for so long that they are now by many thought of as things always known, indeed obvious, rather than as truths established by careful, intelligent inquiry. As an example the principles set forth by Newton 300 years ago are in a sense fundamental to all machine design, as is Faraday's work to the whole electrical industry, in either case the practical realization of what was implied, though hidden, in their work was very slow. It has now become clear that it pays to hasten this development of the idea into the practical tool or process; that the common reservoir of knowledge is no longer sufficient and therefore that industry must, for its own sake, man the pump. The results are providing us with continually better tools —using that word in the widest sense—and improving our control over the conversion of the materials supplied by Nature into the things we seem to want.

In conclusion, this brief survey of the growth of industrial research in recent years in the United States, and of its growing significance everywhere, leads us, in my opinion, to the belief that its influence will continue to grow and spread, because in short, the net advantage accruing from it is already so very great; and holds promise of being greater. The field has been little more than scratched, yet the harvest has been so bountiful that we shall continue to cultivate the field in the confident expectation of reaping still larger crops.

*Address delivered at the Conference on the Relation Between the Industries and the Technical Schools, held at Lehigh University.

General Dyestuff Release

The General Dyestuff Corporation in "Fast Corinth Salt V Conc." is placing upon the market another addition to the line of fast color salts to be used in conjunction with the products of the naphthol series. This new salt is the color salt of the Fast Corinth V Conc. Base, which latter product because of the difficulty of obtaining proper diazotization, is not being offered to the trade.

The new product is coupled in the same way as the other fast color salts and is said to produce with various naphthols of the AS range, extremely rich corinth and chocolate shades possessing very good fastness to washing, boiling soda and chlorine and good fastness to light. The maximum solubility is about 7 oz. per gallon of liquor and it is suitable therefor, for all branches of cotton dyeing. I. G.-429.

(Continued from page 70)

VIOLET

Colour Index No.	Dyestuff	Hydro	Hydro and Caustic	Caustic	Sulphuric Acid	Nitric Acid	Benzol	Pyridine	Pyridine and Caustic
	Indanthrene Printing Violet BBF	Green Yellow	Orange	Green to Bordeaux	Violet	Unaltered	Blue Violet	S. Violet	Green to Green Yellow
	Indanthrene Brilliant Violet RRBA	Red Violet	Blue	Blue	Green Blue	Unaltered	S. Violet	Red Violet	Red Violet
969	Hydron Violet BH	Tan	Yellow	Green Yellow	Violet	Unaltered	S. Violet	S. Red Violet	Dull Green
969	Hydron Violet R	Tan	Yellow	Green Violet to Light Green	Violet	Unaltered	Violet	Blue Green	Blue Green
	Hydron Bordeaux R	Brown	Blue	Violet	Light Pink	Unaltered	Insoluble	S. Red Violet	Orange Brown
	Hydron Bordeaux B	Tan	Olive	Violet	Bordeaux	Unaltered	S. Violet	Light Violet	Dull Pink
	Helindone Violet R	Olive	Yellow	Reddish Brown	Violet	Unaltered	Red Violet	S. Red Violet	Yellow
	Helindone Violet B	Olive	Yellow	Reddish Brown	Violet	Unaltered	Red Violet	S. Red Violet	Yellow
1219	Helindone Violet BB	Olive	Yellow	Reddish Brown	Blue Violet	Unaltered	Violet	S. Violet	Yellow
1074	Anthra Violet B	Olive	Yellow	Reddish Brown	Blue Violet	Unaltered	Violet	S. Violet	Yellow
1221	Ciba Violet 3 B	Green Yellow	Yellow	Brown	Violet	Unaltered	S. Violet	Violet	Green Yellow
1222	Ciba Violet R	Green Yellow	Yellow	Bordeaux	Violet	Unaltered	Red Violet	Red Violet	Green to Yellow
1208	Ciba Bordeaux	Green Yellow	Yellow	Tan	Violet	Unaltered	Pale Violet	Pink	Tan
1205	Ciba Heliotrope 3	Pale Violet	Yellow	Yellow	Violet	Unaltered	S. Red Violet	Pale Violet	Tan
1104	Cibanone Violet R	Reddish Brown	Blue	Blue	Blue to Green	Unaltered	Insoluble	Insoluble	Insoluble
	Anthra Bordeaux B	Brown	Blue Black	Violet	Dull Pink	Unaltered	S. Pink	S. Pink	Dull Pink
1222	Ciba Violet B	Yellow	Yellow	Yellow	Blue	Unaltered	Violet	Violet	Green to Yellow
1143	Anthra Bordeaux B	Brown	Reddish Brown	Brown	Reddish Brown	Unaltered	S. Pink	Red	Orange
1141	Algol Bordeaux 3 B	Tan	Brown	Brown	Green Blue	Unaltered	S. Pink	Pink	Orange
	Alizarine Indigo Violet B	Yellow	Orange Yellow	Brown	Green	Unaltered	Insoluble	Green Blue	Yellow
1104	Indanthrene Brilliant Violet RR	Slightly Redder	Blue	Blue	Green	Unaltered	Insoluble	S. Red Violet	Dull Violet
1105	Indanthrene Violet 3	Bordeaux	Blue	Blue	Blue Green	Unaltered	S. Red Violet	Violet	Violet
1163	Indanthrene Violet Bn.	Reddish Brown	Dull Blue	Dull Blue	Dull Orange	Unaltered	S. Violet	Pink	Bordeaux
1135	Indanthrene Brilliant Violet RK	Slightly Redder	Brown	Blue	Bordeaux to Green	Unaltered	Insoluble	Violet	Blue Green
1161	Indanthrene Red Violet RRK	Brownish Pink	Violet	Violet	Scarlet	Unaltered	Insoluble	Insoluble	Insoluble
1134	Indanthrene Brilliant Violet BBK	Slightly Redder	Brown	Blue	Violet	Unaltered	Insoluble	Violet	Green
	Indanthrene Brilliant Violet 4 R	Reddish	Blue	Blue	Blue Green	Unaltered	Insoluble	S. Red Violet	Brown
	Indanthrene Brilliant Violet 3 B	Slightly Redder	Blue	Blue	Blue	Unaltered	Insoluble	Insoluble	Insoluble
1212	Indanthrene Red Violet RH	Reddish Brown	Tan	Browner	Red Violet	Unaltered	Red Violet	Pink	Bordeaux
1144	Indanthrene Corinth RK	Brown	Reddish Brown	Unaltered	Unaltered	Unaltered	Insoluble	Insoluble	Insoluble
	Indanthrene Printing Violet RF	Yellow Olive	Orange	Bordeaux	Violet	Unaltered	Red Violet	Violet	Green to Green Yellow
	Indanthrene Printing Violet BF	Yellow Olive	Orange	Red Brown	Violet	Unaltered	Violet	Violet	Green to Green Yellow

Present and Future Program of the Color Certification Laboratory

By Waldon Fawcett

ODDLY enough, one finds on the popular side, rather than on the technical side, the phase of the present and prospective work of the Color Certification Laboratory, U. S. Department of Agriculture, which is deepest in ultimate significance for chemists and for the dyestuffs industries. At first glance, there might appear little of moment to practical men in the project of the U. S. Food and Drug Administration for the conduct of a public educational campaign on the harmlessness of "permitted" and "certified" coal tar colors for food. In reality, the success of this missionary work has direct relation to the volume of consumption of food colors—consumption that has been increasing steadily but scarcely in proportion to the increase in population.

Inspiration for this drive to enlighten the public on the safety of approved food colors came from the discovery by the Department that the old prejudice against artificial colors dies hard. Indeed, the tenacity of the superstition that fabrcs dyed green are proof against moths, is not comparable with the stubbornness of the fetish in unenlightened quarters that all chemical colors are poisonous. As a result of investigations the Federal officials further came to the conclusion that the lingering traditional prejudice against coal-tar colors was kept alive in part by the publicity of food packers who boast that their products contain only vegetable colors, as though this implied aspersion upon coal-tar colors were of itself a vindication.

In the interval of nearly a quarter of a century since the Government took over the certification or regulation of the use of coal-tar colors for food, routine references to this activity have been found in various official publications. But there has been no studied, consistent effort to acquaint the general public with the purposes of the Federal censorship nor its success in fostering the provision of artificial colors which increase the attractiveness of food without in any way impairing its palatability or wholesomeness. This lack of a popular educational movement it is now trying to supply. By means of radio talks simply-phrased articles supplied to the daily press, and statements to organizations of housewives, the Department officials are endeavoring to, once for all, rout the obsession which has operated against the fullest consumer acceptance of the colors vouched for by Uncle Sam.

The missionary work is directed in part to an explanation of the fact that coal-tar colors, which pass the rigid Federal tests, may be accepted in full confidence of the highest purity. In other part, this campaign is designed to puncture the fallacy that vegetable colors are pure and safe simply because these are of vegetable derivation. The officials are pointing out to the lay audience that many vegetable colors pass through processes of extraction and concentration which are fairly comparable to the chemical reactions that take place in the manufacture of the simpler artificial colors. And, with facts drawn from their own analyses, they point out that a vegetable color may be as dangerous to human health as any of the coal-tar dyes that are rejected under Government inspection.

Aside from the propaganda of the Department of Agriculture, the Department of Commerce will shortly circulate a forceful alibi for certified colors prepared by Mr. Horace T. Herrick, Principal Chemist in charge of the Color Certification Laboratory. Mr. Herrick, in this and other similar pronouncements, is assuring the public that a pure, nontoxic coal-tar dye is no more dangerous than so much common table salt and that coal-tar colors as a class are not only no more harmful than vegetable colors but are far more satisfactory for tinctorial purposes. Further than that he is seeking to promote a more intimate acquaintance on the part of the public with the Governmental system of supervision by explaining how colors are certified under the three heads, primary colors, repacks and mixtures, and why it is that in the case of the latter affidavits and analysis are far less complicated than in the case of primary colors.

For all that the Food and Drug Administration is, in effect, setting up latterly an organized resistance to what it deems unwarranted assumptions on behalf of vegetable colors in disparagement of coal-tar products, no move has yet been made at Washington to bring vegetable colors within the Federal censorship. This, despite the fact that aggrieved producers of artificial colors have cited examples of vegetable colors alleged to carry impurities far in excess of the tolerances allowed for coal-tar products. And despite the fact that private critics have hinted that a certain food producer, who advertises extensively rigid restriction in his operations to the use of vegetable colors, is, all the while, a heavy purchaser of coal-tar products.

Aside from the educational campaign above mentioned, the coming year schedules for the Color Certification Laboratory little beyond what passes for routine work. This latter is, however, steadily increasing. For example, in the face of the check to business in general, the year 1930 saw the certification of a total of 318,849.5 pounds of straight dyes—more than in any previous year, with the single exception of 1929. The 1930 record of 1,272 batches exceeded considerably any previous year and with only thirty-nine rejections. This, despite the fact that the Color Laboratory has appreciably stiffened, during this past year or two, its exactions in respect to lead, an insistence that bothered some of the producers for a time.

It may be noted just here that two courses are open to the owner of a rejected batch of permitted color. The material may be diverted to the output of textile dyes or it may be apportioned, little by little, to successive batches of food colors, care being exercised that the injection

does not bring the composite above the maximum tolerance. The first mentioned method of disposal of rejected food colors is however steadily losing in availability as more and more food packers are showing a reluctance to purchase food colors from firms that also produce textile dyes. At the Department there is, unofficially, a certain sympathy for this attitude inasmuch as the deadline of purity in the case of the food colors is 82 per cent as against a 50 per cent level found in some textile dyes.

There is no expectation at Washington that this year will see the addition of any new colors to the fifteen dyes now on the permitted list. Indeed, the feeling at the Department is that, on the basis of shrinkage of consumption, certain approved colors might warrantably be dropped from the present list. No move to that end has, however, been made or is contemplated. Some requests have been received at the Department for the approval of a Brown but the position has been taken that all existing needs may be served by the colors already enrolled. There is some call also for an oil Red and a very special line of complications has been precipitated by the demands of manufacturers who desire to tint the skins as well as the body of frankfurters. In passing it may be mentioned that Department officials, by reference in some of their radio talks, have sought to pave the way for acceptance by the public of the Brilliant Blue FCF, the certification of which was the prominent feature of the record of 1929-30.

The radical new trend in food control policy which—beginning with the Substandard Act, applicable to canned goods—substitutes rigid, legislative standards for the administrative standards heretofore employed in enforcement of the Federal Food Act, is not expected to increase the use of food colors nor the censorial work of the Color Laboratory. There is, however, a constant expansion of the research work on intermediates which this institution carries on, in its dual service capacity, for the U. S. Bureau of Chemistry and Soils. That is another story, too lengthy for telling here. That it is of moment to the industry is attested by the fact that only recently the Laboratory passed along for trial by a commercial manufacturer a new intermediate which promises to open the way for the domestic production of dyes which, under present conditions, are imported in volume approximating 400,000 pounds.

Pontamine Fast Blue RR

Pontamine Fast Blue RR, a direct dyestuff yielding brilliant reddish blue shades of excellent light fastness, has just been announced by the Dyestuffs Department of E. I. du Pont de Nemours & Company. It is stated that this color penetrates very well, is exceedingly soluble and sufficiently level dyeing for use on the padder or jig, as well as on all types of machines used for dyeing cotton yarn and rawstock. Extreme fastness to light and brilliancy of shade are said to make this color exceptionally valuable for application on draperies, curtains, upholstery, and similar materials.

Optical Society to Have Special Meetings on Color

The Optical Society of America will hold a three-day meeting in New York, February 26, 27 and 28. The first day and a half will be devoted to special meetings on color. The program will include groups of papers on Industrial Color Standards, Colorimetric Instruments, and Color Specifications. The order in which these several groups will be given has not as yet been determined. The place of meeting will probably be the Museum of Peaceful Arts, 220 East 42nd Street, where an extensive color exhibit will be in progress. It is possible, however, that the room available at the Museum may not be large enough so that it may be necessary to change to some other place. Notification of this change, however, will be published in the REPORTER.

Big Laboratories Near Completion

New experimental laboratories, costing more than half a million dollars, which will house the research facilities of the Hercules Powder Company, are nearing completion. The main laboratory building and a number of smaller units have been finished and are awaiting installation of equipment.

The new location near Wilmington represents a closer contact of the company's research department and its main office, the laboratories being moved here from Kenvil, N. J. The new research laboratories will be formally opened within the next few months, it is stated by the company's officials.

Standard Bleachery Is Bought By Poor Brothers

Purchase of the Standard Bleachery in East Rutherford, N. J., by Edward E. Poor, Jr., and Arthur G. Poor, plant manager and production manager respectively of the Passaic Print Works, has been consummated, it has been learned.

The plant has been purchased from the bondholders who, in turn, acquired ownership recently after the organization has been pronounced defunct. A new company has been formed by both Poors to control the bleachery. The new corporate name of the plant will be the Standard Bleachery and Printing Company.

The president and treasurer of the new company is Louis A. Cowley, police court judge of Passaic. Both Edward and Arthur Poor are vice-presidents and Dow H. Drukker, Jr. is secretary.

While the purchase price is now known, it has been disclosed that the bondholders paid $102,500 in cash and in addition, their bonds, amounting to $450,000, a total of $552,500, when they acquired the bleachery.

It is said that there is to be a connection between the Standard plant and the Passaic Print Works, of which Edward E. Poor, father of the two Poor brothers, is president, in that the former will be operated in conjunction with the Passaic plant and yet will remain independent.

New York offices of the new bleachery will be at 320 Broadway.

Chemical Society Elects Officers

The American Chemical Society recently elected Prof. Arthur E. Hill of New York University as chairman of its New York section for 1931.

Dr. Hill has been on the staff of the university since 1904 and has been full professor and head of the Chemistry Department since 1912. He has been chairman of the society's Division of Physical and Inorganic Chemistry and is an associate editor of its journal.

Dr. Walter S. Landis, vice-president of the American Cyanamid Company, has been elected vice-chairman of the section and Dr. David P. Morgan, Jr., of Scudder, Stevens & Clarke, is the new secretary-treasurer. Dr. Davidson was named to the executive committee, other members of which are J. G. Detwiler, Prof. R. R. Renshaw and Dr. Foster D. Snell.

A selected list of periodicals reporting research in the field of textiles and clothing has been compiled by the Bureau of Home Economics, U. S. Department of Agriculture, for use in textile instruction in universities and colleges. The list consists of 65 periodicals, each supplemented by a brief explanatory statement of contents. Copies may be obtained free from the Bureau of Home Economics.

WHAT HAVE YOU THAT YOU CAN MAKE OR SELL?

Well rated and highly regarded manufacturing, research and international selling and distributing organization successfully exploiting materials to several chemical consuming industries, desires to expand its operations to include the *Leather*, *Ceramic*, *Paper* and *Textile* industries, either as a manufacturer or sales agency for chemicals and associated products for these fields, or the Paint trade on an item to be manufactured only.

To a manufacturer with a staple or specialty for any of these industries, to a company having such a side-line or by-product, to a chemist who has developed but not exploited something in this classification; in fact, anyone regardless of his interest, we should like to correspond.

All correspondence will be considered strictly confidential. Address: Classified Box No. 662, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Boss Dyer—Experienced in the dyeing of raw stock in all forms, Tops, Worsted, Woolen and Union yarns, also considerable laboratory work. First-class references. Address: Classified Box No. 661, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Chemist — Seven years' experience, manufacturing and research on azo dyes and sulphonated oils. Reasonable salary. Good references. Address: Classified Box No. 648, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

CHEMIST-EXECUTIVE AVAILABLE

Textile Chemist with twenty-two years' practical experience. Graduate Lowell Textile Institute. Four years instructor in Chemistry and Dyeing. Three years theoretical and practical experience in Peroxide Bleaching. Fifteen years in charge of chemical work in large textile plant. Experienced in purchase of dyes and chemicals. Excellent analyst, and one who can interpret results.

Would consider position as technical advisor to chemical or dyestuff executive. Address: Classified Box No. 638, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Tinweighter — 24 years of age; college graduate, with three years' practice as foreman in piece tinweighting department; experience in silk piece dyeing; chemical education, good connection, desires position. Best references. Speaks English, French, German. Will locate anywhere. Address: Classified Box No. 660, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

DYER—Experienced Hosiery Dyer, age 32; desires position. 8 years with Onyx, 4 years, Gotham, as supervisor dyeing. Excellent references. Address: Classified Box No. 659, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

Rayon and cotton dyer, skeins, technical training, 10 years' exceptional experience. Put your dyehouse on paying basis. All types of dyes, perfect matches, fine winding. Best references. Address: Box No. 650, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED

European graduate in color chemistry and dyeing (1912) with nearly twenty years' uniquely wide but well-connected experience, including both commercial management and technical sides; also direction of research in the various allied branches of textile coloration—dyeing of all classes of fibers, yarn and piece, textile printing, manufacture of dyestuffs and intermediates—is open to negotiate with a view to take up a post such as management or directorship of large works or group of works. Reply to "DYESTUFF," S.L.S.S., Ltd., 22, Chancery Lane, London, England.